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ELEMENTARY PHOTOGRAPHY

JOHN A. HODGES.

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ELEMENTARY
PHOTOGRAPHY.

BY

JOHN A. HODGES,

Author of "Practical Enlarging," "The Lantern-slide Manual,' etc.

[AMATEUR PHOTOGRAPHER'S LIBRARY, NO. 7.]

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PREFACE.

WITHIN the covers of ELEMENTARY PHOTOGRAPHY the author has endeavoured to explain, in the simplest possible language, the various processes connected with the production of a photograph, from the buying of the necessary apparatus to the mounting and finishing of the print. With history or with theory the book does not profess to deal. It is intended to be a plain, practical handbook, the instructions contained in which the youngest beginner may, without further assistance, readily comprehend. In the system of tuition which has been adopted it differs from the majority of its predecessors, inasmuch as alternative methods of working have been avoided, and one well-tried formula and mode of working only described. This has been done advisedly, and with the view of preventing that doubt and difficulty which often arises in the mind of a beginner when confronted with a choice of processes.

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ELEMENTARY PHOTOGRAPHY.

CHAPTER I.

Introduction—The Aim of the Writer—Primary Difficulties—Selection of Apparatus—Second-hand Goods—Complete Sets—The Camera—The Size of the Photograph—Pros and Cons—Sizes of Plates—The Half-Plate Recommended—Different Forms of Cameras Described — Good Advice — Probable Cost—Modern Improvements—The Reversing Back—The Swing Back—The Rising and Falling Front—Double Backs—Changing Boxes—The Tripod Stand ; its Attributes ; Cost—Rigidity of Apparatus —Practical Tests.

Most treatises on photography commence by giving a more or less exhaustive account of the history of the art; but, believing that the average reader in nine cases out of ten deliberately skips that portion of the work, I propose to depart from the course which precedent has laid down, and, by omitting all historical references, to that extent be original.

My aim will be to provide the amateur who is about to take up the practice of photography for the first time with such information as will enable him to take a successful photograph. I shall endeavour, as far as possible, to avoid the use of technical language; but when it becomes necessary to do so I shall make a point of explaining the meaning of the terms employed. Writing for the class to which I have alluded, I shall assume an entire ignorance on the part of my readers of all matters pertaining to photography. With theory I shall not attempt to deal—its consideration does not come within the scope of this book.

The first difficulty with which the beginner will be confronted will be the selection of the necessary apparatus. Text-books frequently tell him to be guided by the advice of a friend, but as in the majority of cases he probably will have no friend possessing the requisite knowledge to whom he can appeal, the advice has little practical value. Where, however, competent assistance can be obtained it should certainly be accepted.

The purchase of second-hand apparatus should be avoided by the tyro, for although at times undoubted bargains may be picked up by those whose practical knowledge enables them to form a correct estimate of the value of the articles offered for sale, the novice lacking that knowledge may find himself burdened with apparatus, which will not only be useless to him, but which he may find a great difficulty in disposing of.

Nor should I recommend the purchase of a complete set of apparatus, for, unless a high price be paid for it, in which case no economy will be effected, the quality of the articles supplied will probably not be so good as it might have been had the articles been purchased separately ; and it will, moreover, frequently be found necessary to considerably supplement the list of articles comprised in the "complete" set, before it can be made really ready for work.

Naturally the first piece of apparatus which will claim our attention is the camera, which, it will probably be unnecessary to state, is the instrument to which the lens is attached, and by means of which the sensitive plate is exposed to the action of light. Now before we buy our camera we must decide what sized photographs we wish to produce, and in coming to a decision on this point there are two important factors to which we should give due consideration, namely, the amount of money which we wish to expend, and the extent of our powers of endurance, because the carrying of heavy apparatus in the field is more or less a tax upon one's strength, and if the weight of the "kit," as the complete *impedimenta* of the photographer is usually designated, be greater than we can carry without inducing a feeling of fatigue, a great part of the pleasure and profit which we should otherwise derive from our hobby would be lost. I can speak with some authority upon this point, for during the sixteen years that I have practised photography

I have worked with cameras of all sizes, from 12 by 10 downwards, and the experience so gained leads me to the conclusion that if comfort and convenience are to be studied, the size known as half-plate should not be exceeded.

The sensitive plates, and the cameras in which they are used, it may be here convenient to state, are made in certain standard sizes according to the following list:—*$3\frac{1}{4}$ by $3\frac{1}{4}$, or lantern plate, so called because it is of the same dimensions as an ordinary lantern slide; $4\frac{1}{4}$ by $3\frac{1}{4}$, also called "quarter-plate;" *5 by 4, *$6\frac{3}{4}$ by $3\frac{1}{4}$ (used for producing stereoscopic pictures); $6\frac{1}{2}$ by $4\frac{3}{4}$ (called also "half-plate"); *$7\frac{1}{4}$ by $4\frac{1}{2}$, $7\frac{1}{2}$ by 5, *8 by 5; $8\frac{1}{2}$ by $6\frac{1}{2}$ ("whole-plate"); *9 by 7, 10 by 8, 12 by 10, 15 by 12, 18 by 16. I have mentioned weight as being one of the matters which should be considered in deciding upon the size of the camera; but the question of cost also largely bears upon the subject, for the intending purchaser should bear in mind that, though the difference in the initial cost between a small camera and a large one may not be very great, the expense will not end there, for the large camera will necessitate the use of large plates, more chemicals, and, in fact, a greater all-round expenditure. The popular sizes are the quarter-plate, the half-plate, and the whole-plate, and of these I strongly recommend the reader to purchase the half-plate, and I do so for the following reasons. In the first place the size is well proportioned, and it makes a pleasing picture, sufficiently large, when suitably mounted, to look well framed and hung upon a wall; its weight, with the necessary accessory apparatus, is such that it may be carried without discomfort by persons of ordinary physique, while the cost of the plates and materials necessary for the production of the finished pictures will be but moderate. The quarter-plate is rather too small, and when proficiency is attained its possessor would probably sigh for something larger The whole-plate, on the other hand, will probably prove too heavy for most people to carry about with comfort, and the necessary plates and materials will cost more than double the amount necessary to work a half-plate.

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[*] Those sizes marked with an asterisk should be avoided, as, not being generally used, a difficulty is sometimes experienced in obtaining the plates.

The would-be purchaser, upon entering the showroom of a dealer in photographic materials, will probably experience some embarrassment in endeavouring to make a selection from the numerous cameras which will be placed before him. But a closer examination will reveal the fact that, broadly speaking, all the apparently different cameras are really constructed upon one or other of two principles, of which figs. 1 and 2 may be taken as types. In fig. 1, the more modern type, the pinion, by which the focussing of the picture is effected, is in front, the bellows being conical. Lightness and compactness are the advantages of this form of camera. The other, and older, type of camera is shown in fig. 2, and it will be seen that, in this case, the focussing is effected from the rear by attaching the pinion to the back frame which holds the focussing screen. This form of camera is rather more bulky and slightly heavier than the one last mentioned, but for practical work is to be preferred. I would here most strongly advise the reader to expend a reasonable sum in the purchase of his camera, and not to yield, from mistaken motives of economy, to the temptation of buying an instrument which may prove both cheap and nasty. A good, serviceable, half-plate camera, with three double backs, will be found to cost from about £4 10*s.* to £6, according to the degree of finish bestowed upon the instrument.

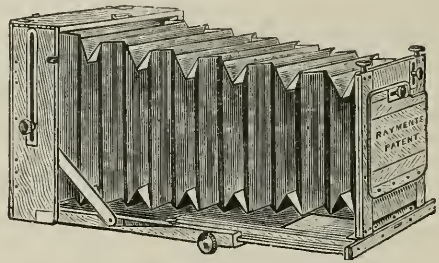

Fig 1.

Most modern cameras are provided with certain adjustments, some of which may be regarded as essential to successful working. The first of these is what is called "the reversing back"; this addition allows the position of the ground-glass to be reversed, and, without disturbing the camera, enables the user to take either an upright or a horizontal picture.

Another very essential feature in a perfect camera is what is known as a swing back; this is an adjustment which enables the ground-glass to be brought parallel with a building when the tilting of the camera is unavoidable. The use of this adjunct will be fully explained hereafter.

The third important movement is the rising and falling front. It consists in providing the front of the camera which carries the lens with an up and down motion, and its use enables the position of the picture on the focussing-screen to be varied. These three special movements, reversing back, swing back, and rising and falling front, are here enumerated in order that the reader, when purchasing, may stipulate for their inclusion in the camera which he selects. With the camera will be provided a certain number of thin wooden cases, usually three, for holding the sensitive plates; these are technically known as double backs, or dark-slides, each being capable of holding two plates. An alternative method of carrying and exposing the plates is by the use of what is known as a changing box; but I only mention the device here to warn the reader

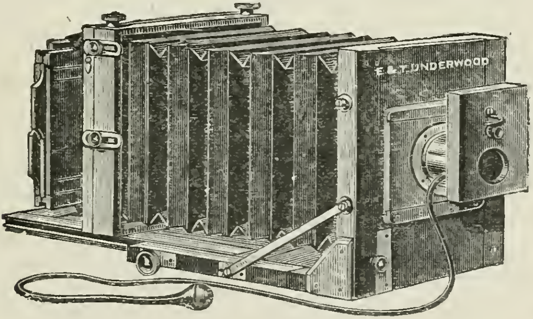

FIG. 2.

against adopting it, as in the hands of a novice it would most probably fail.

The next piece of apparatus to which we may turn our attention is the tripod stand upon which the camera is supported. There is an immense variety of tripod stands in the market, but a great many are of no practical use. The two points to be looked for in selecting a tripod are that its height should be capable of adjustment, and that when fully extended it should be rigid and free from tremor. The form of tripod which I advise the reader to purchase is that known as the sliding-leg pattern; it is a stock pattern, and can be obtained at most dealers for about 12*s.* 6*d.* The head should be sufficiently large to present a firm base upon which to rest the camera.

Rigidity is one of the most essential features of the camera and stand, and with a view of determining whether the apparatus selected fulfils this condition, the would-be purchaser should insist upon the tripod selected being set up to its full height, and the camera screwed into position upon it. It is useless to place a rigid camera on a shaky stand, and equally so to put a rickety camera on a firm tripod. In each case the stability of one piece of apparatus is negatived by the defect in the other.

Taking the apparatus in its proper order the lens would be the next part of the outfit to receive consideration; but as its selection is an important matter, and one that requires to be dealt with at some length, I propose to devote a special chapter to it.

CHAPTER II.

THE LENS.

Preliminary Advice—A Good Lens Essential—Different Lenses Described—The Single Lens—The Rapid Rectilinear—The Wide-angle Rectilinear; its Special Feature—The Portrait Lens—Definition of Terms—Focus—"Stops" or Diaphragms—Waterhouse, Iris, and Revolving Diaphragms Described—The Use of "Stops"—Aperture of a Lens—Distortion—Angle of View; its Determination—Examples—Practical Advice on the Choice of a Lens—English Makes Preferred—Cheap Foreign Lenses—Cost—The Use of the "Wide-angle" Lens—The Care of the Lens—Practical Hints on the Preservation of Lenses.

THE lens, without doubt, is the most important part of the photographer's equipment, and it is essential that he should provide himself with a good one. He may contrive, with some personal inconvenience, to turn out satisfactory work with a faulty camera, but with an indifferent lens he can never hope to produce good pictures.

I do not intend to perplex the novice by attempting to lure him into the study of photographic optics; yet it will be well for him to acquaint himself with the different forms of lenses in general use, and the special purposes for which they are constructed. I intend, therefore, to deal with the subject solely from a practical point of view, and to eschew theory entirely.

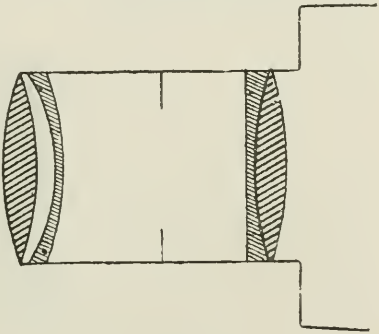

FIG. 3.

If certain expensive lenses of recent introduction are excepted, there are only three varieties of lenses in ordinary use with which the beginner need trouble himself, unless, indeed, he should aspire to portraiture, when another form of lens must be added. These consist of the single landscape lens, the rapid rectilinear, the wide-angle rectilinear, and, if portraits are to be taken, the portrait lens. I will now briefly describe the special properties of each.

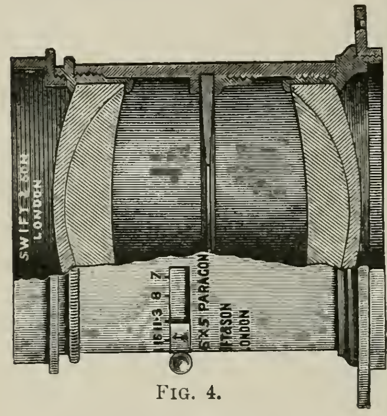

FIG. 4.

The form of the single landscape lens is shown in fig. 5, which is a sectional drawing. The advantages of this lens are its cheapness, and its suitability for general landscape work; its disadvantages being its slowness compared with the rapid rectilinear, and the property it possesses of causing the straight lines in a building to appear in the photograph slightly curved. Although the beginner is frequently recommended to select this lens for his first experiments in photography, I think the next lens which I shall describe, namely, the rapid rectilinear, is more suitable. This lens, the sectional view of which is given in fig. 4, is in more general use probably than any other. It is more rapid in action than the single lens, and can, therefore, be better used for taking

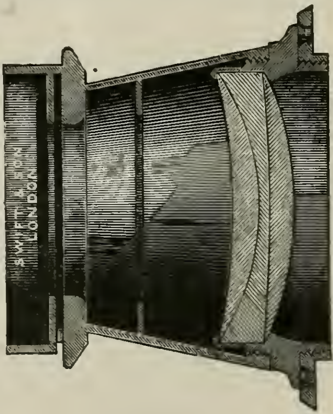

FIG. 5.

portraits and groups, as well as for instantaneous views. It is a non-distorting lens, and will not produce the curvature of straight lines which was referred to as being a fault inherent in the last-named lens. The third lens on our list—the wide-angle rectilinear—shown in fig. 6, is also a non-distorting lens, and its chief feature, as its name indicates, is the power which it possesses of including in the picture taken with it a very large angle of view. It is not so generally useful as the rapid rectilinear, both on this account and also because its rapidity is considerably less; but, where a second lens can be afforded, it is the one that should be chosen, as it is extremely useful for certain classes of work, notably the photographing of architecture, both interior and exterior, when it is often desirable to include a large portion of the subject in the picture. The portrait lens (fig. 3), as its name implies, is intended for portrait work only. On account of its construction, it is suitable only for that special work, and should not be used for any other, and as it is an expensive lens, when properly constructed by a maker of repute, the tyro will do well not to be tempted to purchase one unless he intends to make portraiture a special study.

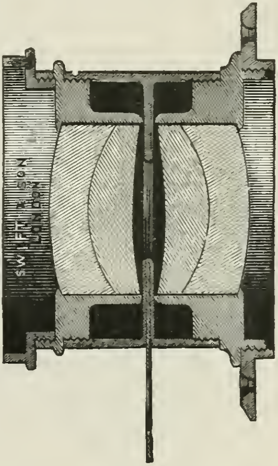

FIG. 6.

Before we can intelligently further discuss the pros and cons of different forms of lenses, it will be necessary to define the meanings of certain technical terms to which it will be impossible to avoid reference.

The focus of a lens is the distance between the lens and the ground-glass when the image appears sharply defined thereon.

The stops or diaphragms are the plates of metal with which most lenses are fitted, which, when inserted in the slot in the lens mount provided for the purpose, contract or reduce the aperture of the lens. It will be easily understood that the smaller the stop which is inserted, the slower will be the working capacity of the lens, and consequently the longer the exposure necessary. Instead of the perforated plates of metal, or Waterhouse diaphragms, just described, the lens may be fitted with what is known as the Iris diaphragm (fig. 7), which consists of a series of thin metal plates overlapping each other, arranged concentrically within the lens mount. By simply rotating a ring fixed to the outside of the lens mount, any sized opening may be obtained at will. This form of diaphragm possesses several advantages—being attached to, and forming part of the lens, it is not possible, as sometimes happens with loose stops, to either lose them or leave them at home. Most opticians now supply their lenses fitted with either form of diaphragm, and although the Iris diaphragm is rather more expensive than the Waterhouse diaphragm, I strongly advise the tyro to choose the former. There is yet another kind of diaphragm to which reference has not been made. It is called the "rotating" diaphragm, and consists simply of a circular plate, in which different sized openings are cut. It is, like the Iris, permanently attached to the lens, and by simply causing it to revolve, any sized opening can be brought into the centre of the lens. It is generally only fitted to two classes of lenses, namely, the simple landscape lens and the wide-angle doublet.

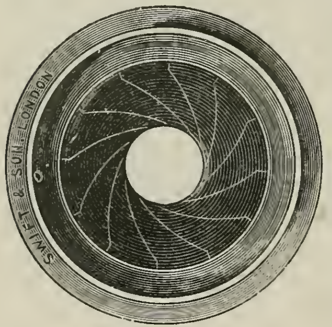

FIG. 7.

The object of using stops is to increase the defining power of the lens. If we examine the image thrown by the lens on the ground-glass, we shall find that, although some portions of the picture appear sharply defined, or, as a photographer would say, "in good focus," the rest of the picture is more or less blurred. To remedy this, we insert a medium-sized stop, and we now see a great change in the appearance of the image, which, instead of being blurred and fuzzy, appears sharp and distinct. I shall have more to say upon this part of the subject when I assist the reader in taking his first negative.

The aperture of a lens is the diameter of the stop used in relation to the focal length of the lens, and the size of the diaphragm is usually expressed by dividing the focal length of the lens by the diameter of the stops. For example, we will suppose a certain lens has a focus of 8 in., and we find, upon measurement, that the largest stop measures 1 in. in diameter. $8 \div 1 = 8$, therefore the aperture of the lens with that particular stop will be $f/8$, and so on. The stops of nearly all modern lenses are marked according to this system; therefore, although it is necessary that the beginner should understand its meaning, he will not have the trouble of making the calculation for himself.

Distortion is the defect in single lenses, and improperly constructed doublets, which causes straight lines in the object photographed to appear curved or distorted in the picture.

By the term *width of angle* is meant the amount of the subject photographed which the lens will include upon the plate. The rapid rectilinear lens which we have advised the student to purchase is what may be called a medium angle lens, and the pictures produced by it, when it is used on plates of the size which I shall recommend, do not suffer from that appearance of exaggerated perspective which is sometimes seen in photographs taken with wide-angle lenses. The width of angle of any lens is determined by the length of its focus in relation to the length of the base line of the picture. For example, an angle of 28° is obtained on a plate one-half the focal length of the lens; an angle of 37° on a plate which is two-thirds the focal length of the lens; an angle of 53° on a plate the same length as the focus of the lens; and an angle of 74° on a plate which is one and a-half times the focus of the lens —and so on.

I have already intimated that it is most important that the lens selected should be a good one, and I strongly advise the reader not to attempt to economise by buying a cheap and possibly inferior instrument. His safest plan will be to deal direct with an English lens *maker*, not a *dealer*, of whom there are several from which to choose. He should also be informed that there are vast numbers of foreign lenses imported into this country by photographic dealers, who engrave their names upon the mounts, and the novice may easily but erroneously infer that the instruments are manufactured by the firms whose names they bear. Now I do not wish for a moment to disparage instruments of this class; many of them are most excellent, but, on the other hand, some are utterly worthless. I have frequently met with cheap foreign lenses which, for practical purposes, were equal to the best of English manufacture; but there is always the chance of getting a bad one, whereas if an English maker of repute be dealt with, *he* will take care, for the sake of his own reputation, that he does not issue an inferior instrument. As a rough guide on the question of cost, I find that the average price, less cash discount, of a half-plate rapid rectilinear, with Iris diaphragm, charged by either Beck, Crouch, Swift, Taylor & Hobson, or Wray, is about £3 10*s.* With such a lens the beginner may rest content until he has acquired some proficiency, for with it he can take either landscapes, buildings, or even his "sister, cousin, or aunt"; though, if he be wise, he will not attempt either of the latter until he can with some degree of certainty produce presentable reproductions of the two first-named classes of subject. He will then probably begin to find that there are certain occasions when his rapid lens does not give him a sufficient amount of the subject on the plate; as, for instance, when circumstances compel him to approach very near to a building. For this purpose, and for photographing interiors, it is often necessary to use a short-focus, or wide-angle, lens, and in buying such an instrument all the foregoing observations made in reference to the rapid lens apply with equal force. Therefore, if a second lens can be afforded, it should be, for use on a half-plate, one of the wide-angle type of about 5 in. focus.

Being in possession of a good lens, the amateur should take proper precautions to preserve it from injury. Every lens as sent out by the maker is provided with a leather cap with which to make the exposure; this, however, in the case of a doublet, only serves as a protection for one of the glasses, and to preserve both from injury a little wash-leather bag, made double and padded with cotton wadding, should be made to contain each lens. The glass of which the lens is constructed is very highly polished, and although it is necessary, for the success of the photograph, to keep the surfaces free from dust, yet great care must be taken not to use any material which would cause scratches. If the lens is fitted with the Iris diaphragm it will seldom be necessary to unscrew the glasses to clean their inner surfaces, as dust will not easily find an entry through that form of diaphragm ; and when it becomes necessary to clean the outer surfaces, a piece of the finest chamois leather should be cautiously applied, taking care to apply it very lightly and with as little rubbing as possible.

CHAPTER III.

ACCESSORY APPARATUS.

Focussing Cloths; Velveteen, Mackintosh, etc.—Camera Cases; Necessary Caution—Non-actinic Lamps—Dishes; Good Advice —Plate Washing Tank—Another Method—Measures—Draining Rack—Printing Frames, etc.—The Chemicals Required—How to Preserve their Properties—Pyrogallic Acid—A Word on Poisons —A List of Chemical Substances Necessary—The Cost—The Use of the Brush.

Assuming that the advice given in the previous chapters has been acted upon, and that camera, lens, and tripod stand have been selected, we may now turn our attention to the various minor apparatus which it will be necessary to purchase before we shall be ready for work.

A focussing cloth will be required. Velveteen makes a good one, or black twill may be used, but in the latter case the material must be used double, in order to get sufficient opacity. Waterproof cloth or thin mackintosh is sometimes recommended; but I cannot advise its use, for in hot weather the heat is unbearable, and the perspiration from the body condenses on the ground-glass and interferes with focussing. Whatever the material, the focussing cloth should be of good size, say, 3 ft. 6 in. by 3 ft.

A case of some kind, to contain the camera and slides and other apparatus necessary for use in the field, must be obtained. These are generally made of leather, waterproof cloth, or canvas. The latter are far to be preferred in that they are very much the lighter. A leather case is, of course, more durable, and affords greater protection to the apparatus; but, on the other hand, it will very often weigh as much as the camera itself, and will, consequently, add very much to the fatigue of carrying the apparatus. A light collapsible case of either waterproof cloth or canvas should therefore be chosen, care being taken to have it fitted with a reliable lock. Make it an invariable rule never to leave the case unlocked, for it should not be forgotten that servants and children, and sometimes more responsible individuals, are frequently of an inquisitive turn of mind; but if the above precaution be taken much disappointment and annoyance will be avoided.

A non-actinic lantern will be required, patterns of which are shown in figs. 8 and 9. It is immaterial which is selected. Do not, however, choose too small a one, or the combustion will be imperfect. For travelling purposes one of the folding pattern lamps will be the most convenient, in which coloured fabric takes the place of ruby glass. These are triangular in shape, and pack quite flat (fig. 10).

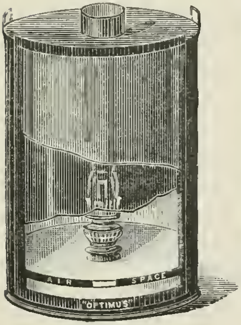

FIG. 8.

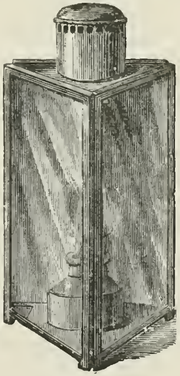

FIG. 9.

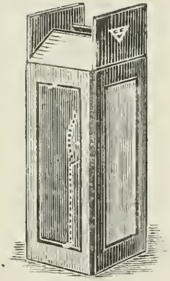

FIG. 10.

The various manipulations, which the sensitive plates and papers used by the photographer undergo before they become finished pictures, are usually carried out in shallow dishes, or trays, which are constructed of various materials. It will be necessary, therefore, to purchase several of these of different sizes. Each dish should be reserved for one particular purpose. One of the so-called secrets of success in photography is the observance of strict cleanliness in all the operations, and the avoidance of the least mixing or contamination of one chemical with another; the slightest trace of a foreign substance in some of the solutions will be fatal to good results. We shall require one black half-plate ebonite tray for developing our negatives, and one white one of the same size to be only used for a process, hereafter to be described, called intensification. A deep white porcelain dish, 8 by 5, will also be wanted to contain the fixing bath. I recommend different materials and colours, as the beginner will then get accustomed to using a particular dish for a particular purpose, and will be less likely to make mistakes. He will also require, for the various operations connected with printing from the negatives, four 10 by 8 deep porcelain dishes. Purchase at the same time a bottle of "artist's black," and with a small brush write on the outside edges of each dish one of these inscriptions; this will aid in keeping each dish to its proper use:—(1) Toning dish, (2) Washing dish, (3) Fixing dish, (4) Fixing dish for bromides.

A zinc plate washing tank, with grooves to hold the plates vertically, and a syphon to carry off the contaminated water from below the plates, is a very great convenience, if not a necessity; the price will be about six shillings. A cheaper but less satisfactory method of washing negatives is to place them face upwards, in a large porcelain dish, changing the water at frequent intervals.

Some graduated measures for making up solutions and holding developers must be procured. One of 8 oz., two of 4 oz., and one of 1 dram capacity should be chosen.

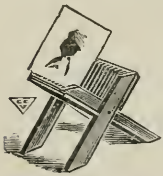

Fig. 11.

A wooden plate-draining rack (fig. 11), for stacking the plates upon after they have been washed, and while they are drying, will be required.

Some printing frames, of half-plate size, for holding the negative and paper during printing, must also be obtained. The pine frames are the neatest, and cost about 1*s.* each. Three will be sufficient at first.

A pair of scales and weights with glass pans, and a set of grain and drachm weights, will nearly complete the list of requisites.

I have, as yet, said nothing about chemicals, but I shall proceed to give a complete list of those that will be required. All chemical substances, when in the form of either crystals or powder, should be preserved from the effects of the atmosphere by being kept in either wide-mouthed glass bottles or jars. These can be purchased at very small cost, or even ordinary pickle jars, which have been thoroughly cleaned and dried, may be employed, provided they are fitted with a sound bung, which may be made to fit tighter, and at the same time will be more easily removable, if a circular piece of clean wash leather, slightly larger than the bung itself, be first of all wrapped round it. Some substances, from their volatile or corrosive nature, require to be kept in stoppered bottles, and these will be denoted by an asterisk. It is, presumably, unnecessary to add that all chemicals and solutions should be stored out of the reach of children, and by preference kept under lock and key. The amateur who has no chemical knowledge should be informed that many of the substances which he will have occasion to employ are exceedingly active poisons, therefore the necessity for caution will be apparent. It is unnecessary to add that all bottles should be properly labelled—books of labels can be purchased for about 6*d.*

The following chemicals will be required,—

Pyrogallic acid (1 oz.), price about 1*s.* 1*d.* This substance is of a very poisonous nature, although the fact is not generally known among photographers. There are, however, few cases on record where it has been taken internally. Its effects on the human system are slow, and there are no certain antidotes. I only mention the matter here because pyro., as it is usually called, is so very generally and often carelessly used in entire ignorance of its poisonous properties.

Sulphite of soda (1 lb.), cost about 1*s.* This chemical is added to the developer to prevent the pyrogallic acid from becoming discoloured, which it rapidly does without this addition.

Bromide of potassium (2 oz.), about 4*d.*

Hyposulphite of soda (6 lb.), 1*s.*

*Liquid ammonia (·880) (4 oz.), 4*d.* This is exceedingly volatile, and must be kept in a stoppered bottle. The fumes are very pungent and injurious to inhale; therefore, in opening the bottle care should be taken to hold it well away from the face.

Oxalate of potash (1 lb.), 10*d.*
Sulphate of iron (1 lb.), 3*d.*
Acetate of soda (½ lb.), 4*d.*
Chloride of gold (Johnson's) (15 gr. tube), 1*s.* 9*d.*
Alum (1 lb.), 2*d.*
Citric acid (¼ lb.), 6*d.*
*Glacial acetic acid (2 oz.), 6*d.*
Bichloride of mercury (1 oz.), 4*d.*
*Perchloride of iron (1 oz.), 4*d.*
*Sulphuric acid, 1 oz.
Hydroquinone, 1 oz.

The cost of the foregoing chemicals, with the necessary bottles to contain them, will be about ten shillings, and, although a smaller quantity might be sufficient for the beginner's immediate needs, yet it will be found more economical to purchase in quantity, the rate per ounce being, in most cases, considerably higher than that per pound. The chemicals should always be the best obtainable. Cheap chemicals are worse than useless, therefore always go to a respectable dealer for them.

In addition to the apparatus already referred to, two camel's-hair brushes should be obtained, one a flat one about 1½ in. broad, and the other an ordinary round mop, such as is used for water-colour painting. The former is to be kept for the special purpose of dusting each plate, both before it is placed in the dark slide, and afterwards when it is removed from the slide and placed in the developer. The smaller brush is to be used to remove any air bubbles from the plate, which sometimes form when it is in the developer. This must be washed after use, or the solution will quickly cause its destruction.

CHAPTER IV.

THE DARK-ROOM AND ITS FITTINGS.

The Dark-room Described—Effect of White Light upon Sensitive Surfaces—How to Provide the Dark-room with Non-Actinic Light—Stopping up all Chinks admitting Light—How to Make a Developing Table and Sink—Laying on the Water—How to Make a Grid—The Operating Table—Shelves—The Importance of a "Tidy" Dark-room Enforced—Other Details—Ventilation, How to Ensure it, etc.

THE apartment in which the photographer carries out his operations is usually, but erroneously, termed "the dark-room," for it is not in reality, or should not be, "dark," in the ordinary acceptation of the term, at all. It is not, of course, illuminated in the ordinary manner with daylight, the light with which it is provided being of an orange or ruby colour, which has no prejudicial effect upon the prepared sensitive dry-plates. My readers will, of course, understand that the packets of sensitive dry plates must only be opened in such a light as that to which I have just referred, and that the exposure of them for even a fractional part of a second to ordinary white light will render them absolutely worthless for photographic purposes.

It is highly desirable that the photographer should secure, for his own exclusive use, an apartment which he can convert into a dark-room; but as this is not always possible, I shall, in the present chapter, describe the fitting up of an ordinary apartment as a dark-room, and in the succeeding chapter I shall also describe a method of constructing, from ordinary materials, a contrivance which will serve as an efficient substitute. Any small room, or even a large cupboard, may be converted into a dark-room, although in the latter case adequate provision must be made for proper ventilation.

Let it be assumed that a room of the dimensions given in the drawing, namely, 12 ft. by 10 ft., has been secured, the first thing to do will be to devise some means of blocking out the white light and providing an abundant supply of orange, or non-actinic light, as it is called, in its place. We will further assume that there is only one window in the room to deal with. We therefore, with stout brown paper and some strong paste, proceed to block out all the upper panes, by pasting two thicknesses of brown paper over them. We then make a wooden frame large enough to just cover the lower sash frame, and upon this we stretch, with the assistance of some tin tacks and strong glue, two thicknesses of yellow fabric which is obtainable at any photographic warehouse. When this is quite

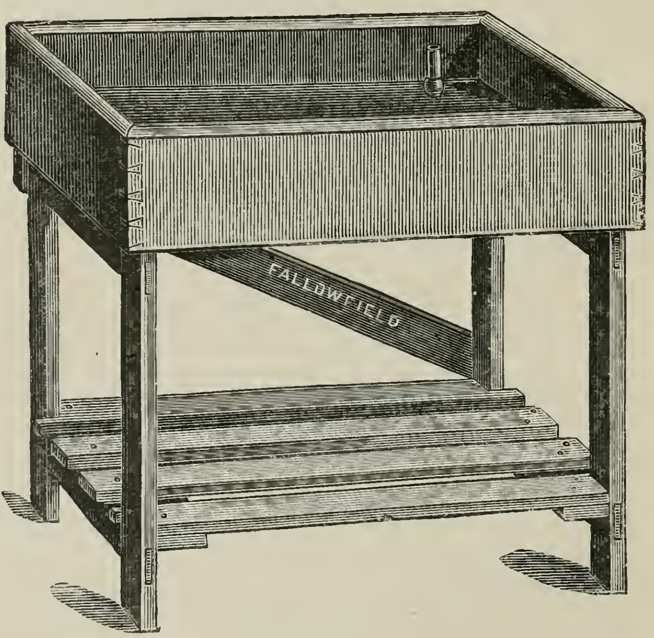

FIG. 12 (OPEN).

dry, one thickness of deep orange paper must be pasted over it. This screen, when placed in position, will allow an abundance of soft orange light to pass through, which will have no injurious effect upon the plates. In order to prevent any stray rays of white light peeping through between the screen and the sash, the back portion of the screen frame should have a broad strip of felt nailed all round it. Two turn-buttons, screwed to the window frame, will keep the frame in position. If direct sunlight falls upon the window, this light will not be safe, and to make it so a piece of ruby cloth, the full size of the screen frame, should be hung inside by means of small hooks; it can then be easily removed when the sun ceases to shine upon the window. Having put the screen in position, and allowed the eyes to become accustomed to the subdued light, it will be necessary to look round the room with a view to the detection of stray beams of light coming from chinks and cracks in the door; the brown paper and the paste will be of assistance in stopping up these.

The developing table and sink must now be considered. Those of my readers to whom expense is not a matter of consideration may prefer to buy one of the very complete and handy developing stands shown in fig. 12, which may be obtained from any of the dealers; but to others who may wish to construct their own apparatus, when possible, the following suggestions may be useful:—Obtain some ordinary floor-boards, which are usually about 6 in. broad and $\frac{3}{4}$ in. thick. Cut two pieces 3 ft. long, and two pieces 18 in. long; nail these together so as to form a kind of bottomless tray. Nail this with long "cut nails" to the wall about 3 ft. from the ground just under the window, screwing to the front two additional pieces 3 ft. 6 in. long to form legs and give support. A thin nail driven slanting through the support, and into the floor, will make the framework quite firm. Now call in a plumber, and tell him to make you a stout zinc tray just large enough to fit in your wooden tray, to which it may be attached by turning over about an inch of the metal all round the top, and securing it with nails to the top of the frame. A hole should be cut in the centre of the zinc tray, and a piece of lead pipe attached to carry off the waste developer and washing water. This directs our attention to an important matter, and one in which the assistance of the plumber may be invaluable. A plentiful supply of water is almost a *sine quâ non* in photographic operations, and, if it is within the bounds of possibility, water should be laid on to the dark-room from the house cistern, or, preferably, from the main. The tap should be fixed about 8 in. above the sink, and should not be too large, as a heavy stream of water is not needed. Fig. 13 gives a rough sketch of the details of construction. In order to avoid the necessity of standing dishes, etc., in the bottom of the sink, which soon will become dirty and contaminated with the constant stream of refuse chemicals, a grid will be necessary. To make it, cut

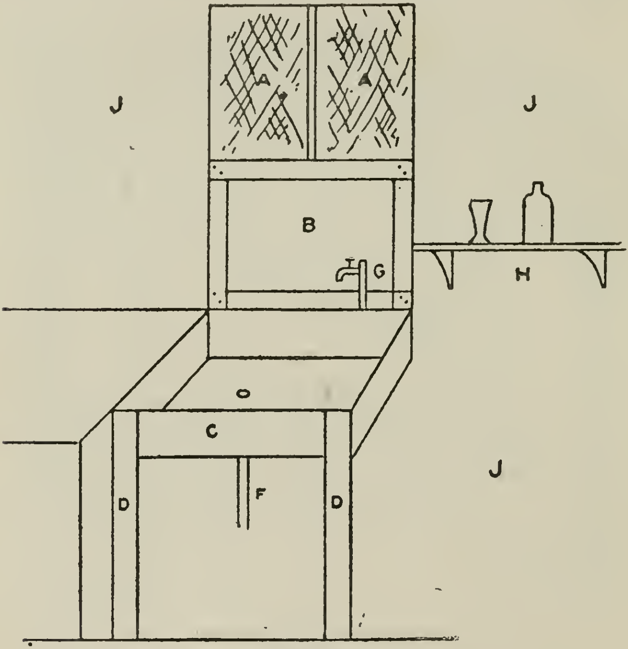

FIG. 13.

some thin strips of wood about $\frac{1}{4}$ in. less in width than the width of the sink, and nail these about $\frac{1}{2}$ in. apart to two pieces of wood 12 in. long by 5 in. deep; the grid will then present the appearance shown in fig. 14. A large common deal dressing-table, which can be obtained second-hand for about 3*s*., should be placed against the wall level with the developing sink, and on the wall at the back a tier of shelves should be put up upon which to place the various chemicals which have already been purchased. The shelving may with advantage be continued right round the room, for although the necessity for it may not be apparent at first, the amateur photographer will be surprised to find how, after he has practised the art for a short period, the various paraphernalia incidental to its pursuit accumulate, and he will then be glad to find that he has made some provision for its reception. A tidy and well-appointed dark-room is a great comfort to its owner, an untidy one an everlasting source of discomfort and ill-success. To the right of the window a broad, low shelf should be fixed, within easy reach of the hand when seated at the developing sink, upon which a measure, and the bottles containing the various developing solutions, can be placed.

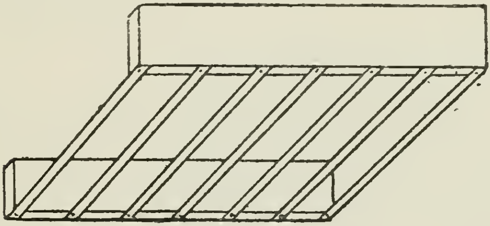

FIG. 14.

If it is impossible to bring a supply of water to the sink an effort should at any rate be made to connect the waste pipe with the nearest drain or gutter, otherwise it will be necessary to place a pail, or other receptacle, underneath the sink to catch the sloppings and waste water, and it will, moreover, require constant vigilance on the part of the operator to see that the pail does not overflow and allow the contents to find their way to the ceiling of the apartment beneath.

While it is necessary to stop up all chinks and crannies which admit promiscuous rays of light, it is also important to take precautions to ensure the efficient ventilation of the dark-room, for the reader will probably find, if he becomes at all enthusiastic, that a considerable portion of his leisure will be spent there. If a fireplace exist in the room, matters will be simplified, and little will remain to be done. With a centre bit about an inch in diameter bore out a row of holes about an inch apart in the bottom of the door near the floor, and just above these nail a piece of wood, the edge of which has been bevelled off, so that it may stand out at an angle, as shown in the sketch at fig. 15. This, in conjunction with the fireplace, will ensure a current of air continually passing through the room.

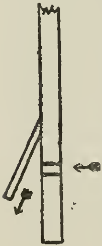

Fig. 15.

If the foregoing directions have been carefully carried out, the reader will be in possession of as comfortable and practical a dark-room as even the most experienced of photographers could desire, and his operations will be much facilitated. At the same time it must not be supposed that possession of a properly appointed dark-room is absolutely essential to success; were it so, the very large army of amateur photographers would be sadly thinned. Many amateurs, under the exigencies of their surroundings, are compelled to either work under conditions which, to say the least, are adverse to success, or to give up the practice of their hobby. In the next chapter I propose to describe the construction of a portable dark-room, which may be made from very ordinary materials and at a nominal cost by any one able to use a hammer and a saw.

CHAPTER V.

HOW TO MAKE A PORTABLE DARK-ROOM OR DEVELOPING CABINET.

A Substitute for the Dark-room—Commercial Developing Cabinets—A Portable Dark-room—How to make a Developing Cabinet—The Materials Required—The Sink—The Bench or Table—The Shelves—A Rack for Dishes; its Construction—The Grid—Water Supply—The Cistern—The Curtain, How to Fix—Ventilation—Concluding Hints, etc.

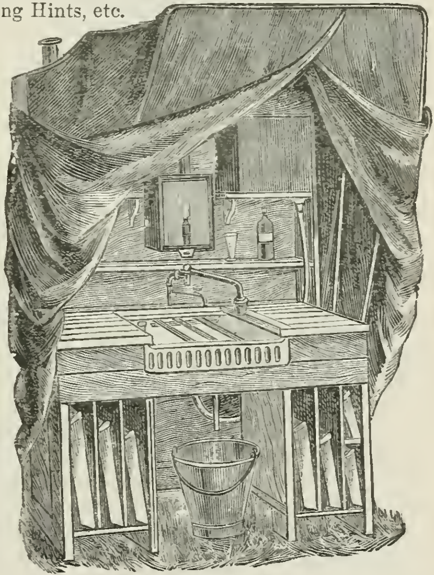

FIG. 16.

I PROPOSE in the present chapter, for the benefit of those who cannot obtain the exclusive use of a room for the purpose of fitting it up as a dark-room on the lines already laid down, to describe a modification of a very useful piece of apparatus which I made for myself some years ago as a temporary dark-room for developing collodion negatives, which can be easily made by any one capable of using ordinary tools, or, failing such skill, by any carpenter from simple materials, and at very little cost. Of course, if the reader is prepared to incur the necessary expenditure he need not put himself to even this trouble, for he may purchase one of the many very complete portable dark-rooms which are now offered for sale by different dealers. Of these, that sold by Messrs. Houghton, and shown in fig. 16, may be taken as a type. They are all very similar in appearance and design, although there may be some slight variations in detail. They consist usually of a table or bench for developing, part of which is occupied by a sink, the space underneath being usually fitted up as a rack for the reception of dishes, the upper portion of the back being utilised as a support for shelves upon which the bottles containing the developing solution and other accessory apparatus find a resting-place. A developing cabinet of this description is by no means an unsightly object, nor does it occupy much space; it may therefore be placed in any ordinary apartment, such as a spare bedroom, without seriously disturbing existing arrangements. A still more recent addition to this class of apparatus is the extremely convenient portable dark-room of Messrs. Davenport, a

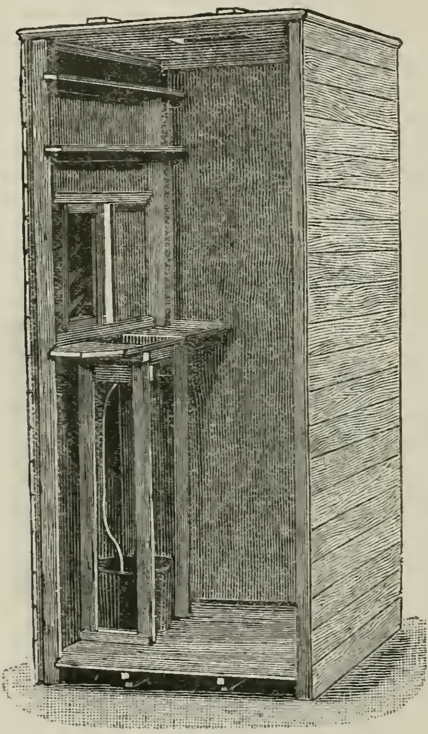

FIG. 17.

drawing of which is shown in fig. 17. These are strongly but lightly made of wood, and only require screwing together. They are very completely fitted with all necessary fittings, including sink, bench, waste pipe, etc., ample provision being made for ventilation. When placed in the corner of an ordinary apartment the "Ever-ready" dark-room, as it is called, might easily be mistaken for an ordinary linen press or cabinet. I certainly think, if the reader is unable to secure the exclusive use of a room, that the possession of either one of the contrivances which have been described, or of a home-made substitute built upon similar lines, may be regarded as essential to successful working. Not only will it allow the reader to work in comparative comfort, but, by preventing the slopping and dropping of the various solutions, and the consequent destruction of furniture and carpets, it will save him from incurring the perhaps not unjust wrath of the "powers that be."

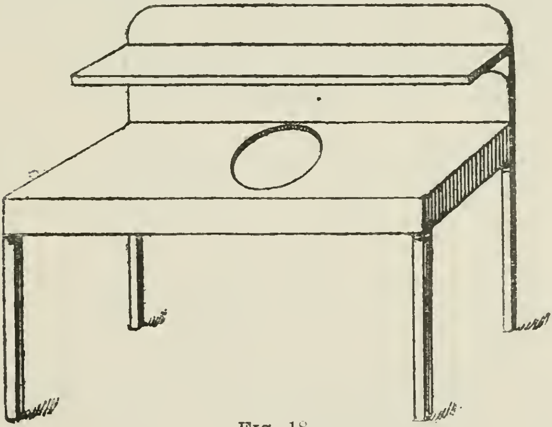

FIG. 18.

I will now, for the benefit of those who may prefer to construct their own apparatus, give a brief description of the home-made contrivance to which I have already referred. At the time when I made it, now some sixteen years ago, I contrived to do all my dark-room work within it, though the process I was then employing, namely, wet collodion, was a far more difficult one to work successfully under such conditions than that with which we are now dealing. I merely mention the fact in order to convince the reader of its practical utility and suitability for the purpose for which it is intended.

As a basis for our operations we must procure from a dealer in second-hand furniture a common deal washstand of the pattern shown in fig. 18. Such an article should not cost more than 3*s.* or 4*s.* Its condition is immaterial so long as the woodwork remains sound. The ravages of soap and water we may easily hide with a little paint.

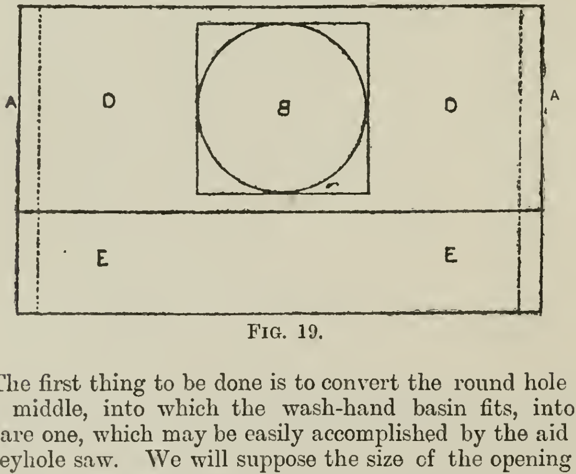

FIG. 19.

The first thing to be done is to convert the round hole in the middle, into which the wash-hand basin fits, into a square one, which may be easily accomplished by the aid of a keyhole saw. We will suppose the size of the opening to be 15 in. square, and we have now to construct the sink; but unless the reader happens to be *au fait* in the use of a soldering iron, it will be necessary to invoke the aid of a plumber, for we require a zinc tray 15 in. square by 4 in. deep, in the centre of which a short piece of $\frac{3}{4}$-inch pipe should be soldered. This tray may then be fitted into the opening, and secured by means of sharp tacks. We now proceed to widen the top of the washstand, so as to give a little more table room on which to work. To do so we screw two fillets of wood at each end, as shown at AA, in fig. 19, which represents the top of the washstand, letting them project about 8 in. A piece of board (EE, fig. 19) 8 in. wide and the exact width of the washstand, is then to

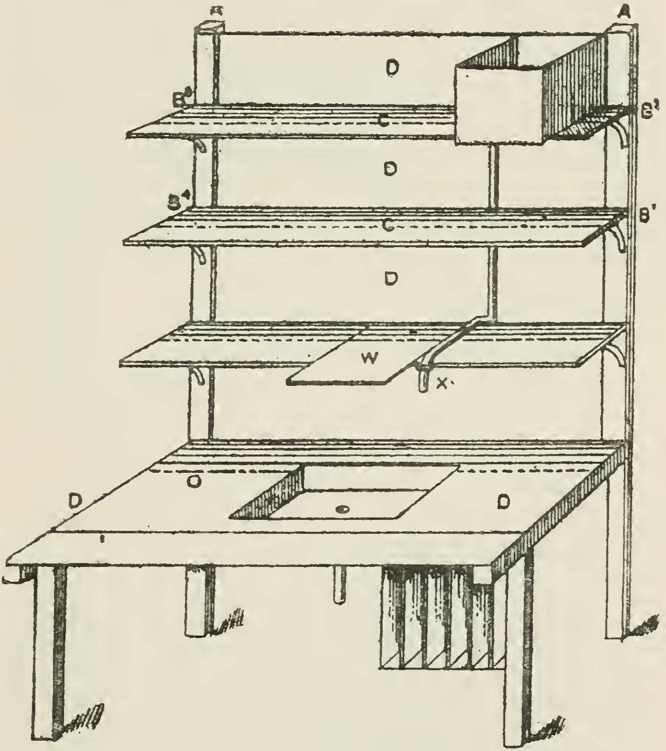

Fig. 20.

be screwed to the projecting fillets, which will afford it the necessary support. This will form the developing table proper. Now obtain some strips of wood about $2\frac{1}{2}$ in. wide by 1 in. thick. Cut off two four-feet lengths and screw them firmly to the back, as shown at AA in fig. 20. In most washstands of the kind to which I am referring a shelf will be found running along the back. This may be left *in situ;* but about 10 in. above it two angle brackets should be attached to the uprights and two more above, as shown at B¹ B² B³ B⁴, in fig. 20, and to these should be screwed two shelves CC. In the centre of the lowest shelf a piece of board 11 in. square, marked W, should be screwed in order to form a broad base upon which to rest the lamp. The back D, D, D may then be filled in by screwing some thin boards, such as those used by picture-frame makers, to the two uprights AA. We now require a rack for our dishes and trays. Obtain two pieces of board 11 in. broad and 18 in. long, and mark them out on both sides with parallel lines, 3 in. apart, as shown in fig. 21. Cut out as many 14 in. lengths from the 11 in. boarding as there are parallel lines, and then nail together at top and bottom with 1 in. fine brads, as shown. When the two end pieces, B¹ B², are nailed on, the rack will be complete. The most convenient place for it will be under the bench to the left of the sink, and it can be fixed in position by screwing with some long screws through the top of the bench.

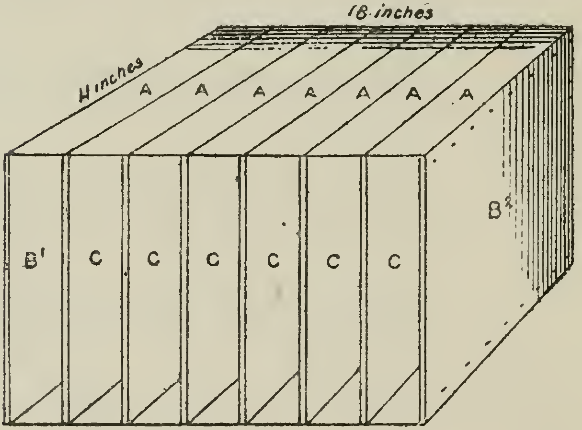

FIG. 21.

The next thing to which we can turn our attention is a grid for the sink. To make it, take two pieces of wood 10 in. long by 3 in. wide and 1 in. thick, and a few laths, like those used for window blinds, 14½ in. long; nail these together about an inch apart, as shown in fig. 22, when the grid will be complete.

We must now make some provision for a supply of water for developing. We may, of course, make shift with a jug and a pail, but a far better plan will be to procure from the nearest grocer one of the tins in which glycerine is stored. These are about twice the size of an ordinary biscuit box, but watertight, and made of much stouter tin; they hold about two gallons of water. This should be placed on the right-hand side of the top shelf, and a piece of ordinary "compo" gas-pipe should be soldered to the bottom, conducted down the upright and carried to the point "X" just above the sink, where a small tap should be soldered. While this supply will, of course, be of no use for plate-washing and other purposes where large quantities of water are required, yet it will be quite sufficient for the ordinary purposes of development, for supplying water for mixing the developer, for rinsing the plates after development, and for the cleansing of measures, dishes, etc. In order to carry off the waste from the sink a piece of flexible india-rubber tube should be attached to the short length of pipe which, it will be remembered, we had soldered to the bottom of our zinc tray, and thence conducted into a pail or other suitable receptacle. If the capacity of the vessel be equal to that of the water-tank, and we make it a rule never to fill the one without emptying the other, an overflow will be rendered impossible. Two coats of Aspinall's enamel over the whole

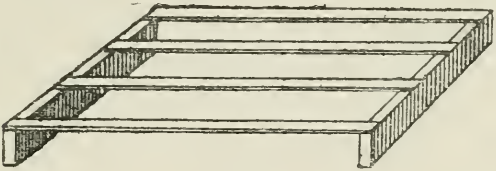

FIG. 22.

will complete our labours; that is to say, if we only wish to work at night, or can completely exclude daylight from the room by means of heavy curtains or a screen constructed according to the method described in the last chapter. If, however, it should not be possible so to arrange matters the apparatus can, with very little further trouble, be so modified as to form in itself a portable dark-room.

To make the necessary alterations, screw firmly two additional uprights, at DD, in fig. 20; and then fill in the sides with thin boarding in the same manner as the back was filled in, in C C C (fig. 20). When the sides have been so filled in the roof may be covered in the same way. The next thing to do will be to make all the woodwork thoroughly lightproof, and the best way of doing so is to paste the outside over with one thickness of stout carpet paper, covering that, in turn, with one thickness of stout Willesden waterproof paper; the inside should also be lined with the latter, as it may then be washed with impunity when it becomes dirty or stained with chemicals. We have now to arrange about keeping out the light from the back, and to effect this a curtain must be provided. It should be made of one thickness of black, and one of orange twill; and sufficient material must be purchased to make, when sewn together, a curtain at least one and a half times as wide as the front of the bench, and its length should be such that it just touches the floor. It must be nailed with tin-tacks to the top and sides of the cabinet. The extreme ends should first be tacked to the top of the uprights, and then the "slack," as it were, got rid of by folding in pleats and tacking each pleat. The tacking should be continued down the sides to just below the table. In order to facilitate the operator's movements in getting in and out, the curtain should be cut up the middle of the back for about three feet of its length from the ground. When the person using the cabinet wishes to change or develop a plate, he lifts the curtain, seats himself on a chair, gathers the loose ends of the curtain round him so as to exclude all light; and in order to assist him in doing so, a few buttons and loops of elastic should be sewn on the curtain inside, which will prevent it from suddenly slipping and admitting an unexpected ray of light. The exact position for these cannot be indicated, but there will be no difficulty in finding the most suitable places.

Some provision for ventilation should now be made, for without it the air in the interior of the cabinet would soon be as foul as the notorious "Black Hole" of Calcutta. Cut, with the keyhole saw, a hole, 3 in. in diameter, in the roof, to which affix an elbow-joint length of stove pipe. This will carry off the heated and vitiated air from the top of the tent. But it will also be necessary to provide a means for pure air to enter and take the place of that which goes out. A sufficient quantity might filter through the curtain, but it will be well not to depend upon that source of supply. At the back of the table or bench, therefore, another hole, 3 in. in diameter, should be cut, and a second elbow-joint affixed in the same manner as before. Care should be taken to turn the mouth of this so that it points in a direction opposite to that in which the window of the room is situated.

If the foregoing directions have been carefully carried out, the reader should be in possession of a developing cabinet, which, although it will have cost him but a few shillings to construct, will, for all practical purposes, be as convenient and useful as a commercially-made article costing as many pounds.

CHAPTER VI.

THE PREPARATION OF SOLUTIONS, ETC.

The Importance of Cleanliness—How to Clean Apparatus—"Ready-made" Solutions—The Developer—How to Prepare the "Pyro." Solution—"The Accelerator"—Potash—Soda—Ammonia; How to make the Solution—"The Restrainer"; How to Prepare—Hyposulphite of Soda; its Properties—The Fixing Bath—How to make Stock Solution of Chloride of Gold—The Toning Bath, and How to Prepare it—Solutions Necessary for "Bromide" Printing—The Ferrous-oxalate Developer; How to Make—The Clearing Bath for Negatives—The Intensifying Solution; Care needed in Its Preparation and Use—The Hydroquinone Developer—Labels; How to Preserve—Distilled Water.

Having made all our purchases, and provided ourselves with proper dark-room accommodation, or its substitute, we have still to prepare the necessary solutions for the various operations of developing, fixing, etc., through which the plate has to pass, before we shall be really ready for work.

At the outset, and before we begin our first lesson in photo-chemistry, let me urge upon the reader the necessity of being careful and exact in the weighing out and measuring of the various chemicals used in making up the different solutions. Slap-dash guess-work will never produce good results in photography, and those who wish to succeed should lay the foregoing advice to heart. To the importance of cleanliness, and the avoidance of chemical contamination of any kind, I have already referred, and to this end one of the small glass measures should be reserved for the exclusive use of making up solutions. After measuring off the requisite quantity of one chemical or solution, the measure should be at once thoroughly washed under the tap, and dried with a cloth kept for the purpose.

Neither measures nor dishes should be put away dirty, or allowed to remain with waste solutions in them, for if this be allowed to occur it will be a difficult matter to again get them *chemically* clean. When apparatus, either glass or porcelain, gets discoloured from such a cause, its surfaces should be brushed, by means of a stiff brush, with a solution of hydrochloric acid 1 part, water 4 parts, and afterwards well rinsed in water. Brookes' soap in the case of porcelain dishes (not glass, the surface of which it scratches and dulls) will be found very useful in removing chemical stains.

The beginner may, if he so choose, though I by no means recommend him to adopt that course, purchase the solutions which he will require, all ready prepared for use, from the dealer from whom he obtained his apparatus. Such a mode of working, however, is so essentially a "rule of thumb" business, that it will probably commend itself to but few of my readers. Let the tyro, therefore, from the very outset, learn to prepare his own solutions, and so place himself in a position of independence.

We will begin work by preparing our developer. The reader, novice though he be, is probably aware that the image which is formed on the sensitive surface of the plate by exposure in the camera is not visible, but requires to undergo the process called "development" in order to make it so.

There are a great many different systems of development in vogue at the present day, each of which has its admirers; but were I to describe them all I should only succeed in reducing the reader's mind to a state of chaos and indecision. I propose, therefore, to describe two methods only, both of which have stood the test of time. In the first pyrogallic acid is the reducing agent, and in the second hydroquinone.

To make the solution necessary for the former, weigh out 3 oz. of sulphite of soda, place it in a *clean* jug, and pour over it 8 oz. of hot water, stir with a glass rod until dissolved. When quite cool add the contents of the 1 oz. bottle of pyro., and, finally, 20 grs. of citric acid. Now add sufficient water to make up the bulk to 10 oz. This should be kept in a stoppered bottle, and labelled "Pyro. solution, No. 1."

The pyro. solution is the true developer, but it requires the addition of an alkali in order to bring out its energy. Solutions of the fixed alkalis, potash, or soda, may be used, or liquid ammonia. In my own practice I invariably use the latter, and I advise the reader to follow my example. To make the solution, take a clean 10-oz. stoppered bottle, and pour into it 1 oz. of the strong ammonia, taking care, for the reasons already stated, not to inhale the fumes; add at once 9 oz. of distilled water—if tap water is used, the solution will probably turn milky, owing to the precipitation of carbonate of lime. Label this No. 2 "Ammonia solution: Accelerator."

But ammonia used alone would cause development to proceed too rapidly, and therefore (for reasons which I shall deal with when I come to write on development) it is necessary to introduce a third substance into the developer, which is called "the restrainer." To prepare it, take another 10-oz. bottle, preferably of a different shape to the last, so that it may be readily distinguished in the dark-room, and pour into it 10 oz. of distilled water, to which add 1 oz. of bromide of potassium. Label this No. 3 "Restrainer."

We now only require one more solution to complete the list necessary for the production of our negatives, and that involves the use of a chemical which is at once the greatest friend and the deadliest enemy to the photographer. Its name is hyposulphite of soda, the familiar "hypo." of the photographer, and its function is to "fix" the negative after development or, in other words, to dissolve out of the film all the sensitive silver salt which has not been acted upon by light and reduced by the developer. It is most essential to keep this substance away from all other solutions —the slightest trace of it in the developer, or in a measure, or a tray used for development, would at once spoil the results. As a large quantity of it will be used, it may be made up in bulk by dissolving in a quart of water as much of the salt as the water will take up, keeping it in a well-corked bottle or jar.

I have said that the above solutions comprise all that are necessary for the development of the negative, but it will be convenient to describe here the preparation of the solutions which will be required when we come to the subsequent operation of printing from it.

For the process known as "silver printing" we shall only require one additional solution, namely, a toning bath, the basis of which is a salt of gold. Before we prepare this we had better take the hermetically sealed tube of chloride of gold, carefully break it, and dissolve the contents in a clean stoppered bottle containing 15 drm. of distilled water. The reason for so doing is that chloride of gold being very deliquescent—that is, prone to absorb moisture from the air—we should lose a great deal of the costly chemical in attempting to weigh out small quantities, whereas, if we make it into a solution of the above definite strength, we shall know that each drachm of it will contain 1 gr. of gold. To make the toning bath, place 4 drm. of acetate of soda in a large bottle, add 2 pints of distilled water, agitate until the crystals are dissolved, and then add 8 drm. (fluid measure) of the gold solution. This solution may be used over and over again until exhausted, when it will refuse to tone; it improves by keeping, and should never be used until after twenty-four hours from the time of mixing.

For the other printing process, which I shall hereafter describe, we shall require a distinct set of solutions, which, as they will keep indefinitely, we may as well now make up. The process I refer to is known as the "bromide process," and prints produced by it are developed in the same way as is an ordinary negative, but the solutions used are different, the particular form of developer known as "ferrous oxalate" being employed. This consists of two stock solutions: one a saturated solution of oxalate of potash, the other a saturated solution of sulphate of iron. By "saturated solution" is meant a solution in which is dissolved as much of the chemical substance as the water is capable of taking up. To make the first, put into a clean jug (the vessel employed should be retained for the purpose, and not returned to the kitchen for future domestic use) half a pound of the crystals of oxalate of potash, and pour over them about 12 oz. of water, stir vigorously, and if after a few hours some crystals remain undissolved, it may be assumed that the solution is a saturated one. The solution will probably present a turbid or milky appearance, due to the presence of oxalate of lime. It should be poured into a large funnel, in which a filter paper has been placed, and filtered into a clean bottle. In this condition it will keep indefinitely. It may then be labelled "Saturated solution of oxalate of potash, No. 1."

No. 2 consists of a saturated solution of sulphate of iron, and to make it proceed in the same way, put half a pound of the sulphate of iron crystals in a clean jug, pour about 10 oz. of water upon it, and stir well. Filter and bottle off, labelling it, "Saturated solution of sulphate of iron, No. 2." Finally, add 10 minims of strong sulphuric acid.

The "alum bath" used for clearing negatives from stain consists of a saturated solution of alum, and is made by dissolving as much of the salt in warm water as it will take up. This solution must also be filtered and labelled "Clearing bath."

The next solution is one that we must both prepare and use with the greatest care, as it contains one of the most active poisons known. It is called "the intensifying solution," and it consists of a saturated solution of bichloride of mercury. It is made by carefully dissolving in 5 oz. of distilled water, ½ oz. of the salt. It should be plainly labelled "Solution of bichloride of mercury," and a "poison" label should also be affixed to the bottle. Its use will be fully explained when we come to deal with the intensification and reduction of negatives.

When we have prepared the next two solutions, we may consider our laboratory arrangements fairly complete. To make them we place in a 10-oz. stoppered bottle 9½ oz. of distilled water; to this we add 160 gr. of hydroquinone. This substance is not very soluble, but constant agitation will effect solution. When it has entirely dissolved, add 2 oz. of sulphite of soda, 60 gr. of citric acid, and 30 gr. of bromide of potassium. Label this "Hydroquinone developer, No. 1." Then, in another clean 10-oz. bottle, dissolve 160 gr. of soda hydrate in 9 oz. of distilled water. Filter, and label "Hydroquinone developer, No. 2."

I have already pointed out the necessity of avoiding any chance of mistaking one solution for another by carefully labelling all bottles. Convenient books of printed labels, containing the names of all chemicals, developers, and solutions in ordinary use, are now to be obtained from most dealers in photographic apparatus. One of these should be purchased, and all our bottles labelled. But if we content ourselves with simply affixing the labels to the bottles by means of the mucilage at their back, we shall probably find that, be we as careful as we may, the labels will sooner or later be affected by a portion of the solution running down from the necks of the bottles after they have been in use, and the effect of this will be that in a very short space of time the labels will become illegible, if, indeed, they do not entirely detach themselves from the glass. This state of affairs can, however, be remedied with very little extra trouble. Dissolve by means of gentle heat about 20 gr. of gelatine in 1 oz. of water, and with a small brush paint over each label, carrying the brush well over the margin of the label on to the glass. Obtain at the oil-shop some hard oak varnish, and, when the labels have become thoroughly dry, paint them over with the varnish in a precisely similar manner with a stiff hog-hair brush. Labels so treated will remain firmly attached to bottles for a very long while, and if at any time they should become discoloured, they may be washed or wiped with a damp cloth.

The photographer should always have by him a sufficient quantity of distilled water—it can be purchased in quantity at a very low rate—and all the solutions should be made up with it. Ordinary tap water is generally contaminated with foreign substances, more or less—many samples of London water being rich in carbonates, while in some country districts organic matter is found suspended in large quantities. By using distilled water difficulties of this kind will be avoided.

CHAPTER VII.

THE MANIPULATION OF THE CAMERA IN THE FIELD.

Getting Ready for Work—A Good Suggestion—Packing the Apparatus — A Word upon Dry Plates—Isochromatic Plates — The "Castle" Plates—Filling the Dark Slides—Procedure — Our Object Defined—The Subject; Artistic Considerations Deferred—Setting up the Tripod—How to Focus — The Use of the Diaphragms; a Good Rule for the Beginner—The Exposure of the Plate—Exposure Tables; the Writer's Advice—Making a Record—How to Expose—Further Details.

Presuming that the reader has carefully read the preceding chapters, and acted upon the advice therein given, he will probably be eager to put his apparatus to a practical test by taking his first photograph. Let him, therefore, pack up his apparatus, and, accompanied by the writer, set out upon his first photographic expedition.

In getting his apparatus together he must be careful to include all the different articles that he will require. Even the memory of the experienced photographer sometimes fails in this respect, and nothing would be more annoying to the tyro than to find after a long and fatiguing walk, when he arrives at his destination, that he has left either his lens, or camera screw, or some other important piece of apparatus behind. To avoid mishaps of this nature, it will be a good plan to write out a list of the following articles, which will always be required, on a stout card, and glue it to the inside of the cover of the camera case. If the articles are then, one by one, packed in the order of the list it will be practically impossible to leave anything behind. We shall require to pack up and take the following articles:—

The camera.
The lens.

The double dark slides, charged with plates.
The tripod head.
The tripod legs.
The focussing cloth.
The camera screw.
A note-book in which to record our exposures.

I have not, up to the present, said very much about that most important subject—the sensitive plate; but it now becomes necessary to devote a few words to it. The manufacture of gelatine dry-plates is at the present time a most important industry, and though (presumably by the process which is known as "the survival of the fittest") the number of actual manufacturers is considerably less than it was a few years ago, the plates which are now issued to the public are, almost without exception, of very high quality. Therefore it matters very little what particular make of plate the tyro selects. Every photographer has a partiality for a particular make of plate, and the reader will probably find, if he were to put the question to four different photographers, "Whose plates are the best?" that he will get as many different opinions. Personally, I have a partiality for Edwards' Isochromatic plates; but as their manipulation involves the exercise of more care than the beginner would be likely to bestow, he had better make his first exposures upon some ordinary plate of good quality, such, for instance, as the "Castle."

Assuming, therefore, that a box of plates has been procured, we take them, with the dark slides, into the dark-room, and having carefully closed the door, and put the non-actinic screen in position, we may proceed to charge our slides. To do so we unfasten the brass clips which hold the two portions of the slide together, and carefully dust the interior with the broad camel-hair brush, laying the opened slide flat upon the table. We then open the box of plates, undo one of the brown paper packets in which they are packed, and, taking the topmost plate, we carefully dust its surface, and proceed to lay it, face downwards, in the dark slide. We do the same with the next plate, and after buttoning down the blackened tin division, we close the slide by folding its two sides together, and refastening the brass clips. Having filled the remaining two slides in a similar manner, we carefully re-pack the unused plates, taking special care to avoid scratching the films, or touching them with the fingers, which would probably cause unsightly marks in the negatives. The dark-room door may then be opened, and we are literally ready for work. The novice will possibly be in doubt at first as to which is the film side of the plate; therefore it may be well to state that the film or coated side of the plate is always less glossy than the uncoated side.

Having packed our traps, we may set out in quest of our first picture. I do not, at this stage, intend to offer any advice on the subject of art, believing that to do so would only tend to bewilder the student, and distract his attention from the purely technical details of the subject, which, in my opinion, he should first thoroughly master. Our only aim, therefore, at present will be to make several experimental exposures on suitable subjects with a view to gaining a little practical experience in the proper use of the apparatus, and also in the development of the negative.

This being so, we need not for the present concern ourselves with "rules of composition," "balance," "light and shade," and the thousand and one artistic considerations which at a later period of our photographic career will probably engage our attention.

Very little time, therefore, need be spent in selecting a suitable subject for our first exposure, although, in order that we may derive as much instruction as possible in the proper use of our apparatus, it would be well to include in the view a house or a building of some kind. We will assume, therefore, that some such subject as this is chosen—a country house, with a background of trees and distant hills, the foreground being composed of a garden with a fence in the immediate front. Probably, if we were to allow artistic considerations to weigh, we should prefer to exclude the uninteresting fence, but for our special object, namely, learning the proper use of our apparatus, it will prove helpful rather than otherwise.

The point of view having been selected, we proceed to erect the tripod, taking care, in doing so, to tightly clamp all the screws, and to extend the legs sufficiently apart to give steadiness. The camera may then be taken from the case, the baseboard let down, and secured by tightening the brass struts at the side, it being finally firmly fixed to the tripod head by means of the brass screw which is provided for the purpose. When the lens has been attached, by screwing it into the flange which should have been fixed to the rising front of the camera, we shall be ready to make our first exposure. Having removed the lens cap, the reader may throw the focussing cloth over the camera, taking care, of course, not to obscure the lens, and proceed to arrange the picture upon the plate. He will at first probably be able to distinguish nothing but a hazy outline of the subject; but if he will place his hand upon the focussing screw, or pinion, at the side of the camera and gently turn it, first towards him, and then away from him, he will find that the image on the ground-glass screen gradually becomes more distinct. Let him now carefully watch one portion of the picture—for instance, the house, which occupies what would be called in technical language the middle distance, and carefully turn the pinion until it appears sharply defined and clear. It is assumed that the index on the ring which adjusts the diameter of iris diaphragm has been in the first instance placed opposite the denominator marked *f*/8, which is the largest opening of the lens. Having focussed the house sharply, he will also observe that both the fence in the foreground and the trees behind the house are, more or less, indistinct and fuzzy. This experiment will show him that a photographic lens is only capable, when used with large stops, of giving sharp definition in one plane, for if he readjusts the pinion, and so gets the fence sharp, he will find that the house in turn becomes as fuzzy as the fence was previously. If, however, he revolves the ring on the lens mount until the index points to *f*/22, and again examines the image, he will find that each plane of the picture, the fence, the house, the trees, and the distant hills all appear crisply defined, or, in photographic language, in sharp focus. He will also note, that although the definition has been improved, the brightness of the image has considerably diminished. It will thus be easily seen that the function of a stop or diaphragm is twofold, namely, to improve definition, but in the same ratio to increase the duration of exposure. The reader will do well *to keep to the use of one sized stop in making his exposures until he can with some accuracy determine the correct time to allow.* There is no magic in *f*/22, or in any other particular sized stop; but that number will be found to give good general definition without being so small as to necessitate an unduly long exposure.

The cap should now be replaced upon the lens, and the ground-glass frame being folded back upon the top of the camera, the double-back marked "1" and "2" may be removed from the case (the focussing cloth having been previously wrapped round it), and slid into the groove provided for the purpose at the back of the camera, the focussing cloth being still kept over all, in order to prevent the slightest chance of the plates being affected by light. This having been done, the hand may be placed underneath the cloth, and the shutter of the dark-slide carefully drawn out to its full extent. The plate will then be ready for exposure.

This question of exposure is a most difficult matter upon which to give practical assistance in a handbook. It is true, that by consulting one or other of the many ingenious exposure tables which have been devised the reader with a taste for mathematics may derive some assistance, but those who are not so skilled will probably prefer to dispense with such aid. For my own part, at this early stage of his novitiate, I think their use would tend more to confuse the reader than render him assistance. In ascertaining the correct exposure without resorting to the use of an exposure table the photographer is naturally compelled to rely mainly upon his judgment; a quality which the novice lacking the necessary experience obviously cannot be presumed to possess. The main factors which guide the photographer in correctly estimating exposure are three: the size of the stop, the brightness of the light, and the rapidity of the plate. It should always be borne in mind that the success of the photograph will depend to a great extent upon the accuracy of the exposure; therefore the novice should carefully note the conditions under which he works, so that he may compare the results obtained one with another. Here the last item on our list of requisites for outdoor work comes to our aid—the exposure note-book. The pages of this will be found to be ruled off under separate headings, such as "lens," "light," "subject," etc., and these should be filled up after making each exposure, and after the plates have been developed, the results obtained, whether good, bad, or indifferent, should also be recorded for future guidance.

But after this digression it is time that we exposed our plate. Assuming it to be a bright summer's afternoon, about four o'clock, we remove the cap, and counting "one," "two," quickly replace it. To make sure, as this is our first experiment, we will make a second exposure, this time giving a slightly longer one. We therefore close the shutter, and turn the little wire clip to prevent it being accidentally withdrawn. The dark-slide is then drawn out of the groove in which it fits, and turned over, so that the side with the ivory tablet marked "2" is towards the inside of the camera. We now proceed in a precisely similar manner to expose the second plate, the only difference being that in this case we count four seconds instead of two. After we have in the same way exposed a third plate, giving, however, six seconds exposure, we can replace our apparatus and return to the dark-room. Our object in making several exposures upon the same view is to demonstrate, when we come to develop the plates, the effects of under and over-exposure, so that we may obtain as much instruction from our first practical lesson in taking a photograph as possible. Correct exposure will, of course, always be our aim; but if we err, it should be on the side of over rather than under-exposure—for this reason, that whereas a passable result may, with care, be obtained from an over-exposed negative, nothing can be done with one which is under-exposed.

CHAPTER VIII.

THE DEVELOPMENT OF THE PLATE.

A Definition of Development—Preparations—Mixing the Developer—A "Normal" Solution Defined—Getting Ready for Work—Procedure—The Avoidance of Dust—How to Apply the Developer to the Plate—Under-Exposure; How to Treat—The Appearance of the Image—How to Examine the Negative—Judging "Density"—Development Continued—A Second Examination—The Appearance of the Image—The Use of the Clearing Bath—Preparing the Fixing Bath—Precautions—Fixing the Negative—The Action of the Fixing Bath Described—Washing the Negative—Draining and Drying—How to Handle a Negative—"Frilling"—A Useful Suggestion—The Appearance of an *Under-exposed* Negative Described.

It has been truly said by no less an authority than Captain Abney, whose works upon photography should be studied by all who wish to excel, that the development of the photographic image is both an art and a science; and probably few experienced photographers will take exception to the statement.

Development, of course, can only be carried out in the non-actinic light of the dark-room, for although the plate has been exposed to light in the camera, and has received therein the image cast upon it by the lens, it is still as sensitive to white light as before, and the slightest exposure to such would totally obliterate the image. This being so, we may take the slides to the dark-room and make the necessary preparations for developing our first negative. We commence by mixing our developer, and, to prepare a "normal" solution, that is to say one of medium strength, neither weak nor strong, which should serve, if we have correctly timed our exposure, to develop a good negative, we proceed as follows. Into one of the 4 oz. measures we pour 3 oz. of clean water, then with the minim graduate we add, in the following order, 60 minims of the "pyro." solution, 40 minims of the "bromide," or "restraining," solution, and 30 minims of the "ammonia," or "accelerating," solution—stirring the mixture well with a clean glass rod.

All white light must now be excluded from the room by putting the non-actinic screen in position at the window. The plate which we first exposed should then be removed from the dark slide, and, after its surface has been lightly brushed with the broad camel-hair brush, laid, with its sensitive surface upwards, in the ebonite tray which we have reserved for developing negatives. Dust is one of the photographer's greatest enemies, and the object of dusting the plate, both before and after exposure, is to remove any small particles which, notwithstanding all precautions, will find their way on to the plate. The developer is now poured, with a gentle sweep, over the plate, in such a manner as to cover its entire surface with one flow of the solution; the operation requires a little knack to perform it successfully, but it is easily acquired. It is for this reason that we have mixed up rather a generous amount of solution, and when the reader gains a little experience he will find that 2 oz. of solution will suffice for developing a half-plate. If the solution does not entirely cover the plate, or only does so in patches, the negative will probably exhibit "developer markings," which may show in the print. It is well, in commencing development, not to allow too much light to fall upon the plate; therefore the dish containing it should be removed to the table, which we have assumed to be on the left of the sink. It is better not to allow the solution to remain stationary, but to rock the dish with a slight oscillating motion, which will cause the developer to flow in even waves to and fro over the plate, and will ensure uniform development and an immunity from stains. The development of the "latent image" is one of the most beautiful experiments which modern science has revealed, and one which cannot fail to fascinate those who witness the process for the first time. If, after the solution has been allowed to remain upon the plate for about two minutes, we perceive no indication of a change in its appearance, we may conclude that the plate has been somewhat under-exposed, and, to remedy this, we measure out another 20 minims of the ammonia solution, pour it into the 4 oz. measure, pour the developer back from the tray on to the fresh solution, and, after a stir with the glass rod, again pour it over the plate. The object of making the addition in this way is to thoroughly mix the solution, for if it were imperfectly mixed, unequal development, or stains, would result, and the negative would consequently be spoiled. The plate must now be carefully watched. Probably after the strengthened solution has been acting upon it for about 30 seconds or so a portion of the plate will begin to darken—the part represented by the sky; this will be followed by the walls and roof of the house; the fence and objects in the foreground will also become visible. At this stage we may remove the plate from the developer, and, after giving it a slight rinse under the tap, to avoid the formation of stains, we proceed to examine it more closely by holding it up to the orange light of the non-actinic screen, not, however, for too long, for undue exposure, even now, might cause a slight veiling or fog. Our hasty scrutiny will show us more distinctly the detail in our negative, but we shall probably notice that although it appeared very black and dense when in the dish, even the darkest portions seem thin when viewed by transmitted light. This proves to us that development has not been carried to a sufficient extent, and if we were to arrest the process here, we should find, when the subsequent necessary operations had been completed, that we had a mere ghost of an image which, for practical purposes, would be valueless. When judging the "density," as it is called technically, of the developed image, we must remember that the negative will always appear to be denser before the next operation of fixing than it is in reality, therefore an allowance must be made for this fact. We, therefore, return the plate to the tray, and having added another ten minims of ammonia solution as before, again pour the developer over it, continuing the rocking motion as before. The appearance of the plate will now quickly alter, further detail will appear, and the image will gain rapidly in vigour, until a point is reached when nearly the whole surface of the plate will appear obscured. The plate should then be again removed from the tray, and after a rinse under the tap, submitted to a second examination by transmitted light. It will now be observed that the image has considerably gained in density, and if the highest lights, that is to say, the blackest portions of the negative, appear nearly opaque, it may be assumed that the plate has been sufficiently developed, and after a good wash under the tap it may be placed in a clean porcelain dish, in which some of the alum clearing bath has been poured, and allowed to remain therein for five minutes, while we are preparing the fixing bath. Into the dish which we reserved for this special purpose, we pour 4 oz. of the saturated solution of hypo., adding to it 9 oz. of water, and well stirring. In all our dealings with this chemical *we must take great care not to contaminate either dishes or measures with it,* and if any of the solution should be spilled upon the table, it should be immediately wiped up with a cloth. The negative may now be removed from the alum bath, and *after another thorough wash under the tap*, should be placed in the fixing-bath. Up to this point all the operations have been conducted in the non-actinic light; but when we have safely placed the plate in the fixing solution, we may remove the non-actinic screen, as white light at this stage will not further affect it. The object of the fixing-bath is to dissolve out of the film all the sensitive silver salt which has not been acted upon by light. It will be instructive to watch the change which the plate will undergo after being placed in the fixing solution. The back of the plate will rapidly lose the creamy appearance which it previously exhibited, and the unreduced silver will be quickly dissolved by the solution. After the plate has been allowed to remain in the fixing-bath for about ten minutes it should be removed, when the back of the plate should have quite lost its white creamy appearance; if, however, some patches of white still remain, the plate must be returned to the solution until all such signs disappear. A quarter of an hour in the fixing-bath is a safe time to allow. *The plate should then be most thoroughly washed to remove all traces of the fixing solution, for if any hypo. be left in the film it will in time cause the negative to become discoloured, if not to entirely fade.* The negative should, therefore, be held by its edges under the tap, and the water allowed to run gently over it for about a couple of minutes, after which time it may be placed in the grooved rack of the washing trough, which should then be placed under the tap, and a gentle stream of water allowed to run through it. About two hours of this washing will be found sufficient for all practical purposes. Although in the course of the foregoing operations it will be impossible to avoid handling the negative to some extent, the tyro should understand the right way in which to do it. The plate whilst wet must never be held between the thumb and fingers, as an indelible impression of them in the gelatinous film would result, which would, of course, be duly recorded in each print made from the negative. When it becomes necessary to examine the plate during development, it should be raised from the bottom of the dish by cautiously slipping the nail of the forefinger underneath it, when, its edges being held between the forefinger and thumb of the other hand, it may be readily lifted from the solution. Even this, however, should not be done more frequently than necessary, as the heat of the hands, more particularly in hot weather, slightly warms the gelatine, and causes the film to partially detach itself from the glass—this defect is known as "frilling."

Let us now remove our negative from the washing tank, and hold it up to the light with a view to ascertaining its quality. Now, it is wellnigh impossible to describe the appearance of a properly exposed and developed negative in language which can be appreciated by the beginner, and I much wonder that plate makers, or dealers in photographic apparatus, have not conceived the idea of selling sets of negatives showing the result of over, under, and correct exposure. Such assistance would be of immense educational value to beginners, and I throw out the suggestion in the hope that some one may think it worth acting upon. Upon examining our negative, we shall, in all probability, find that it is somewhat under-exposed. We, to some extent, anticipated this result when we failed to get any trace of an image with what we called our "normal developer." If we look carefully at the negative, we shall notice, also, that some portions are represented by patches of clear glass in which no detail can be seen. This, however, would not happen if the negative were properly exposed, in which case some detail should be visible even in the deepest shadows, which are represented by the clear portions of the plate. The negative will, probably, also be wanting in gradation; that is to say, a print made from it would appear hard, with chalky high lights and heavy shadows, with an absence of "half-tone," as the intermediate shades are designated. From such a negative it is extremely difficult to obtain satisfactory prints, and, whenever it is possible, it is better to make a second negative, giving a longer exposure than before. When the reader becomes more proficient, and is able to develop a satisfactory negative, he will do well to make it a rule to at once destroy any plate which by miscalculation of the exposure, or from other causes, turns out to be under-exposed, for from such he will rarely be able to obtain even passable prints.

It was with a view to possible errors of this nature that we made the three successive exposures on the same subject recorded in the last chapter, and, with the object of acquiring more information on the subject of development, we will now proceed to develop the remaining plates.

CHAPTER IX.

THE DEVELOPMENT OF THE PLATE (*continued*).

Second Lesson in Development—How to Proceed—The Developer—A Good Rule—The Behaviour of the Plate—How the Image should Appear—A Good Negative—Our Third Experiment—The Mode of Procedure—Over-exposure—How to Remedy—A Modified Developer—The Properties of the Various Constituents of the Developer—An Analysis of Results—Under, Over, and Correct Exposure Described—The Hydroquinone Developer—Its Advantages—Its Disadvantages—" One-Solution " Developers Condemned—The Eikonogen Developer—Its Merits—A " Combined " Developer—How to Prepare it—An Eikonogen Formula—Concluding Advice.

Having carefully followed the instructions for developing given in the preceding chapter, and arrived at the result therein recorded, we proceed to take the second plate in hand, to which, it will be remembered, we gave an exposure of four seconds.

To do so, we begin by making up a developer of the same strength as before, and which stood as follows: Pyro. solution, 60 minims; bromide solution, 40 minims; ammonia solution, 30 minims; water, 3 oz. This we have called our " normal developer," and if the exposure has been approximately accurate, it should be sufficiently strong, with very little further addition of ammonia, to bring up a good negative. The beginner should make it a rule, at any rate until he has gained some experience, to commence development with a solution of a certain strength, and he cannot do better, for general purposes, than adopt the formula which has just been given. By working in such a manner it will be more easy for him to determine whether the plate has been correctly exposed, and according to its behaviour under the normal developer he will be able readily to determine whether it be either correctly, under, or over-exposed.

Having mixed the developer, the routine laid down and described in the last chapter must be again carefully followed. We will assume, therefore, that the plate is in its dish, and that the developing solution has just been poured over it. We must now carefully watch it, and contrast mentally what takes place with what occurred when we developed the first plate.

If all the instructions have been observed, we shall notice that in about a minute that portion of the plate which represents the sky, and which, of course, has received the greatest amount of light, will begin to darken, and then, in proper sequence, the rest of the picture will slowly and regularly appear, and, as the action proceeds, the image will gain in strength and detail till, after the lapse of about five minutes, the whole of the picture will appear to have developed. At this stage the plate should be removed from the developer, and, after a slight wash, may be held up to the orange light for a hasty scrutiny. This will probably reveal the fact that although plenty of detail is apparent in the negative, it yet lacks the necessary density. We, therefore, measure into the developing cup another ten minims of ammonia solution, together with ten of the bromide solution, and again pour the slightly strengthened developer over the plate; the effect of this addition will be to slightly increase the energy of the developer, and in about five minutes we may remove the plate from the solution, wash off the developer, transfer to the alum bath, again wash, and then fix. We have this time succeeded in producing what should be technically a perfect negative.

We will not, however, rest here, but in order to learn as much as we can on this all-important subject of development, we will proceed to develop the remaining plate, to which, it will be remembered, we gave an exposure of six conds. If we reflect for a moment upon the behaviour of the two plates which we have already developed, we shall at once, and rightly, assume that this last plate has been over-exposed. Now there are several methods, when we know that we have over-exposed our plates, by which we can to some extent counteract its effect, and these we shall consider when we have gained a little more experience; but for the present we will adopt the mode of working which has already been advised. We, therefore, mix up for the third time our "normal developer," and apply it to the plate. We must, however, watch its action very closely, for almost as soon as the surface of the plate has become thoroughly wetted with the developer, the image will begin to appear. With the weak solution with which we are working this may at once be accepted as evidence of considerable over-exposure, and prompt measures to counteract the effect of this must be taken. The developer is immediately poured away (for it will be necessary now to mix a fresh one of different strength), and the plate well washed under the tap. A fresh developer is then to be compounded as follows: Pyro., 80 minims; ammonia solution, 20 minims; bromide solution, 80 minims; water, 3 oz. This modified solution is then applied to the plate, which, under its influence, if the amount of over-exposure has not been very excessive, will slowly acquire density. If we refer back to the chapter dealing with the preparation of the various solutions, we shall find the properties of the different constituents of the developer briefly described, and if we follow this out a little further we shall be the better able to understand the reasons for thus modifying the development, and its consequent effect upon the plate.

The pyro., as we have already observed, is the true developer, and the density of the negative will depend, to a certain extent, upon the amount present in the mixed solution. The ammonia, or accelerator, as its name implies, hastens or accelerates the action of the developer, and the bromide solution restrains or retards it. It requires but slight consideration, therefore, to appreciate the general principles which govern the operation of development. In our first experiment we found upon applying the normal developer that the plate was somewhat under-exposed, we therefore accelerated the action of the developer by adding more ammonia, and by increasing the developing energy of the solution, forced more detail to appear in the negative, and gained an increase of deposit. When it becomes necessary to force development in this way, the ammonia should be added cautiously in small quantities at a time, as to add the full amount at once would spoil the negative by causing fog; a defect we shall have something to say about hereafter. The second negative having developed with the normal strength of solution, and having required only the addition of a small quantity of accelerator to complete development, proved that the exposure was as nearly as possible correct. The flashing out of the image, in the case of the third negative, immediately upon the application of the normal developer, conclusively proved that the plate had been over-exposed, and to remedy this, development was arrested by washing off the developer, a new one being applied in which the proportion of restraining bromide was greatly increased, with the view of retarding the action of the solution, and giving the plate time to acquire the necessary amount of density. Indeed, if we were to add a sufficient amount of the latter salt, he developing action would entirely cease. And it should also be noted that when frequent additions of ammonia have to be made, a certain proportion of bromide should be added also, say in the proportion of 1 to 4, or general fog may result.

The foregoing instructions, if carefully followed, although they constitute merely a tithe of what might be written upon the subject, should be sufficient to enable the reader to grasp the general principles involved, and enable him to turn out a satisfactory negative.

Although I have recommended the reader to use for his early experiment the pyro. developer, it should be mentioned here that there are several other alternative methods which may be employed. The oldest of these is that known as the ferrous oxalate method. I do not, however, propose to describe it in detail here, as it does not, in the hands of a beginner, allow so much latitude in exposure as some other methods do, and it will, moreover, be necessary to fully deal with it when we learn how to print upon bromide paper.

The hydroquinone developer has become a great favourite with amateurs, probably owing to the fact that all the chemicals of which it is compounded may be dissolved together and used in one solution, and because it is a very cleanly developer to use, in that it does not cause the hands to become stained. The last-named property is, to some extent, an advantage, particularly if the operator be inclined to be careless in his manipulations ; but to make it a practice to use a "one-solution developer" is a system which cannot be too strongly condemned. Having referred to the advantages of hydroquinone, it is only right to point out its chief defect, which is an almost unavoidable tendency, at any rate in the hands of beginners, to produce negatives of such a character that hard prints result. It is, in fact, difficult to avoid getting undue contrast in negatives so developed, and it is for this reason that I do not recommend its use for ordinary negative work, although for other purposes, such as the production of transparencies, the making of lantern slides, and for copying engravings where density and clearness are essential conditions, it probably has no equal. I have condemned the very general practice of making it up in one solution, for the reason that so doing greatly lessens the control which the user would otherwise have over its action ; but there is no necessity to so use it, and in the formula which has been given we shall employ two solutions. No. 1, containing the hydroquinone, is the true developer, and No. 2 the accelerator. For correct exposure, equal parts of 1 and 2 are taken, further additions of No. 2 being made in the event of the plate being under-exposed. If, on the other hand, the plate is found to be over-exposed, the normal developer is simply diluted with an equal bulk of water, and more time allowed. Full exposure always gives the best results with hydroquinone. Under-exposure generally results in negatives of a character which is spoken of among photographers as "soot and whitewash." There will be found very little tendency to fog when using hydroquinone, unless the plate has been very considerably over-exposed, and the fact should also be borne in mind that it acts more slowly than does pyro., and the time occupied in development is usually longer.

A developer of still more recent origin, the application of which to photographic purposes is due to Dr. Andresen, is the substance which has been called eikonogen, and although up to the time of writing it has not been very generally adopted, yet the results obtained from it are exceedingly promising, and it would seem to have a great future before it. The chief drawback to its employment lies in its comparative insolubility, this property rendering it a matter of impossibility to prepare the developer in a concentrated form. Like hydroquinone, it acts somewhat slowly on the plate, but there the resemblance ceases, for, instead of producing strong, vigorous negatives, with a tendency to hardness, the characteristics of negatives developed with eikonogen are a remarkable amount of fine detail, combined with great softness and an even gradation. It has been suggested to utilise the markedly different tendencies of the two developers by combining the two substances in one solution, so that the advantages of each may be obtained. The following formula, due to Mr. W. H. Walmsley (Philadelphia), will be found to give good results: Solution No. 1, sulphite of soda 240 gr., soda carbonate 120 gr., distilled water 6 oz. Solution No. 2, eikonogen 100 gr., hydroquinone 80 gr., distilled water 6 oz. To make a developer of normal strength equal parts of these solutions are mixed together, 6 parts of water being added. In cases of over-exposure the proportion of No. 1 may be reduced with advantage.

The following is a good formula for an eikonogen developer: Dissolve in 15 oz. of distilled water $\frac{1}{4}$ oz. of eikonogen, 1 oz. of sulphite of soda, and 4 gr. of bromide of potassium; label this No. 1. In 10 oz. of distilled water dissolve 1 oz. of carbonate of potassium; label No. 2. For a normal developer mix the solutions in equal proportions. The detail-giving properties of this developer are very great, and it is most valuable for developing under-exposed plates.

In concluding this chapter upon development I cannot, perhaps, do better than warn the reader against the common practice of trying the plates of first one maker and then of another. If this be done, success will seldom be attained, for if it be imagined that one dry plate is very much like another the assumption is an erroneous one; the fact being that, although nearly all commercial dry plates are of good quality and thoroughly reliable, each particular make possesses characteristics entirely its own, a knowledge of, and mastery over, which the photographer can only acquire by the experience gained by long use. Therefore, having chosen a good make of plate, the reader should studiously avoid all temptation to try rival makes until he can, with reasonable certainty, produce a good negative.

CHAPTER X.

DEFECTS, FAILURES, AND THEIR REMEDIES.

A Common Failing—Fog—General Fog—Chemical Fog—Light Fog—Stains — Frilling — Blisters — Spots — Developer Markings — Mottling of the Film—Insufficient Density—Excessive Density—Halation—Insensitive Markings, etc.

If the beginner has carefully perused the foregoing chapters upon development, and followed out the instructions therein, he will, in all probability, not be long in coming to the conclusion that the apparently simple operation of taking a negative is not quite plain sailing. His path at the very outset will be beset with various difficulties, and it is with the view of enabling him to steer clear of some of these, and to remedy those which are unavoidable, that this chapter has been written. Of one thing the beginner may rest assured, and that is that nine out of ten of the difficulties in which he finds himself will be of his own creation, and not due to any inherent faults in the plates, or apparatus, which he may be using. It is a common fault with many amateurs to endeavour to attribute their failures to defects in their plates; but almost invariably it will turn out, upon investigation, that the user, and not the article used, is to blame. Speaking from my own experience, it is only just to members of the trade generally to state that I have always found them willing to investigate any genuine complaint which may be submitted to them.

Fog.—This is one of the earliest faults, common to all gelatine plates, which the beginner will meet with, and it is due to a variety of causes. The thick, pea-soup-coloured vapour called "fog," all dwellers in London are only too familiar with, but the would-be photographer will probably want to know to what particular condition of things the term is applied when used in a photographic sense. Now, as there are different kinds of photographic "fog," it will be well to briefly describe their characteristics.

General Fog.—This shows itself in a uniform degradation or veiling of the entire image, causing a lack of transparency in the shadows. A negative so affected, when examined by transmitted light, appears literally to be enveloped in a fog, and the beginner will experience no difficulty in recognising it. The defect may exist in a greater or less degree, and its effect upon the results will be that negatives so affected will take a long time to print, the prints themselves being characterised by a general flatness and want of vigour. It may be due to excessive over-exposure, or to the manner in which the emulsion has been prepared.

The defect known as *chemical fog* is one very rarely met with at the present time. It is seldom found except in extremely rapid plates, and is due to error in the preparation of the emulsion. As the beginner should not use plates of the extremely rapid character, in which the defect would be likely to appear, chemical fog need not further be discussed here.

Light Fog is a defect of a totally different nature, and may be caused in a variety of ways. For instance, too long an exposure in the camera, an unsafe light in the dark-room, a defect in the apparatus, or an overdose of ammonia when developing. When the defect is due to excessive over-exposure of the plate there is no cure, as by the time it makes its appearance the mischief is irremediable. When, however, it owes its origin to some defect in the camera, the fact may be ascertained by examining the plate after development. If the margins of the plate, which are covered by the rebate of the dark slide, retain their white appearance during development, it may be safely concluded that the fault is to be found in the apparatus, and not in the dark-room illumination. If the fault is due to the camera or dark slides, they should be at once returned to the maker to have the defect remedied. Light will often find its way round the lens flange and through the slot in which the Waterhouse diaphragms are placed; sometimes, too, the glue by which the bellows is attached to the camera, cracks and allows light to enter. The safety, or otherwise, of the dark-room illumination may be readily tested by allowing an unexposed plate to lie upon the dark-room table, at the distance from the light at which development is ordinarily carried on, for about six or seven minutes, keeping half of it covered with a book. If, upon development, the uncovered portion darkens, the light will not be safe, and an additional thickness of orange paper or fabric should be employed. The reader should, however, understand that very few illuminants are perfectly safe if the plates are exposed to their influence for a very long time, but as an abundance of light, of a suitable character, is a great convenience to the operator, it is better to use it, taking the precaution to avoid unduly exposing the plate to its action at the outset, either by keeping the developing dish covered with a piece of cardboard, or by commencing development at the back of the room. When the image is fairly out there will be less danger of fogging, and these precautions may be relaxed.

Another kind of fog which may occasionally be met with in some makes of plates is called *green fog*. When the negative so affected is examined by reflected light, it will appear quite green, while if looked at by transmitted light it will appear red. The defect is due to the preparation of the plates, and is more often noticed in the case of under-exposed negatives which have been considerably forced with ammonia in development. Its presence, however, will not materially interfere with the printing qualities of the negative. It may be removed by rubbing the dried film with a pledget of cotton-wool moistened in alcohol.

Staining of the Film.—This must not be confounded with any of the varieties of fog previously referred to. If the formulæ for development which have been given are used, this defect will not be met with; but when a simple solution of pyrogallic acid is employed, without sulphite of soda or other preservative, a more or less deep staining of the film results. Such negatives being non-actinic in colour take a long time to print; therefore it is well to remove the stain by placing them, after removal from the fixing bath and washing, in a solution composed cf alum, 1 oz;

citric acid, ½ oz.; sulphate of iron, 2 oz.; water, 10 oz. After a few minutes' immersion the yellow stain will disappear, and the colour of the negative will be changed to a bluish-black.

Frilling is a defect which has already been referred to incidentally in the chapter upon "Development," and it consists in a puckering up of the film, generally near the edges of the plates, and a want of adhesion to the glass. It is rarely met with now, except in very hot weather, when the temperature of the solutions and the washing water is high. At such times the plate should not be handled more than is absolutely necessary, and, whenever possible, the temperature of the solutions reduced by means of ice. The use of the alum bath directly after development will tend to prevent frilling during fixing.

Blisters.—These are really a modified form of frilling, and are sometimes caused by allowing the negative to remain soaking too long in the washing water. Directly it occurs the plate should be removed, and placed in a tray containing methylated spirit; after it has been allowed to soak for about ten minutes it may be removed, and, without further washing, placed in the rack to dry.

Spots.—The formation of these upon the negative are due to various causes, which, in the majority of cases, are preventable. Their appearance, although a minor defect, is one of a most annoying character, for they generally show themselves in a most conspicuous part of the negative; for instance, in the case of a portrait, upon the nose of the sitter, or, in a landscape, in the middle of the sky. Spots caused by dust show as transparent markings; but if the advice previously given be always followed, namely, to brush the surface of the plate before exposure and development, spots due to this cause will never occur. Round, transparent spots, more regular in outline, and larger than the foregoing, are caused by air-bubbles forming on the plate during development. Some plates are more subject to this defect than others. If, during the progress of development, a camel-hair brush be lightly passed to and fro over the plate while it is in the developer, they will be removed before harm is done. It is unnecessary to add that the brush must be kept clean, and for this particular purpose.

Opaque Spots are sometimes met with, and are generally due to some defect in the manufacture of the plates. When they occur, the plates showing the defect should be submitted to the manufacturers for examination.

Developer Markings are often caused by applying the developer to the plate unskilfully, instead of allowing it to pass over the entire surface of the plate in an even wave. They may be also occasioned by not thoroughly mixing the different ingredients forming the developer. The solution should always be thoroughly stirred before applying it to the plate. A general mottling of the plate is also frequently caused by allowing the plate to lie motionless in the developer. When development is protracted the dish should be constantly rocked.

Insufficient Density may result from under-development, over-exposure, or the employment of too weak a developer. The first fault is fully dealt with in the chapters upon development, while the chapter upon intensification provides a remedy for the second.

Excessive Density sometimes occurs, and is the converse of the defect just referred to. It is caused by continuing development too long, or by employing a developer containing too great a proportion of pyro. Some subjects require much less pyro. than others. Assuming the exposures in each case to be correct, a view taken in bright sunshine would require considerably less pyro. to develop it than the same view taken in a dull or diffused light. Subjects showing great contrasts, or a large proportion of white, whether they be whitewashed houses, a chalk road, or a lady's dress, all require a less proportion of pyro. than that given in the chapter upon development. Probably in such cases 3 gr. or 30 minims of the 10 per cent. solution of pyro. to the 3 oz. of developer will be found ample.

Halation is a defect which is very often met with in certain makes of plates which are but thinly coated with emulsion. Such plates the reader should avoid. It is usually only seen when strong contrasts of light and shade occur in the negative. It generally makes its appearance when such subjects as the interior of a church with light streaming through a window, or a landscape with heavy masses of foliage, through which bright patches of sky appear, are attempted. It is probably caused in part by reflected light from the back of the plate; but it seems also to be due to a lateral spreading of the light from a portion of the plate which is brilliantly lighted to an adjacent portion which is in shadow. The evil may be mitigated, if not prevented, by backing the plates before exposure. To do this, mix yellow ochre to a paste with weak gum-water, and apply to the back of the plate with a brush; this, of course, must be done in the dark-room. The plates may then be reared up on end, in a large box, to dry, which they will do in a short time.

Insensitive Markings of an irregular shape, sometimes of an iridescent character, round the margins of plates, are met with after development, in plates which have been kept too long, or which have been exposed to damp or to the fumes of gas. Plates should always be stored in a thoroughly dry place, *not* on the upper shelves of a cupboard, or room, in which gas is burnt. Exposed plates must never be packed in paper which contains printed matter of any kind, as contact with the printing ink will inevitably ruin the negative.

CHAPTER XI.

THE INTENSIFICATION, REDUCTION, AND VARNISHING OF THE NEGATIVE.

Controlling Density—Difficulty of so Doing—How to Determine the Quality of a Negative—The Best Course—Intensification—Want of Permanence—Necessary Precautions—How to Proceed—Reduction—How to Effect it—Necessary Solutions—Trial Prints—How to Varnish a Negative.

The beginner will find, after he has exposed a few plates, that one of his greatest difficulties will be to produce with certainty just the requisite amount of density to give a good print. Some of his negatives will be much too dense, while others will be far too thin. At first he will probably not be able to determine, by a mere inspection of the negative after development, whether it is of a character to give a good print or not; but upon taking a trial print he will find that in some cases he can only succeed in getting a flat muddy-looking picture without contrast, or vigour, and that in others the negatives take an abnormally long time to print, and the results, when attained, are hard and crude. The first of these defects is due to over-exposure, the employment of too vigorous a developer, or one containing too little pyro.; and the second to under-exposure, or too prolonged development, or to both combined. Of course, the *best* thing to do in such cases, when it is practicable, is to make a fresh negative by exposing another plate on the subject, modifying the exposure in the direction indicated by the result obtained in the first instance. But there are many occasions when it is impossible to do this, and when, at the same time, it is very desirable to get as good a result from the defective negative as it is possible to obtain. Now, fortunately for the photographer, there are two processes by which negatives possessing either of the above-named faults may be to some extent improved, and these are called "Intensification" and "Reduction." The meaning of the two terms is probably sufficiently obvious without further explanation. The first one with which I shall deal—namely, Intensification—is applied to a process by means of which the density or opacity of the negative is increased or strengthened, when from any cause it is too thin to give a good print. The second term, Reducing, is applied to the converse process, namely, that of reducing or lowering the density of a negative when it is excessive. It will be readily understood that these two processes, when intelligently employed, place a wonderful power in the hands of a photographer. But, notwithstanding, my earnest advice to the beginner is to aim at producing, by careful exposure and development alone, a perfect printing negative requiring no after treatment, and he should always try to avoid the necessity of resorting to either process. However, as I have said, it sometimes happens that partial failure will occur, and then it is that the processes of intensification and reduction stand us in good stead.

There are many formulæ given in text-books for compounding intensifiers, but I do not intend to discuss their relative merits here, nor do I wish to depart from the broad system which I have endeavoured to carry out in writing this book, of presenting one practical and well-tried mode of working to the reader, rather than confuse him by describing alternative methods.

The particular intensifier which I shall advise the reader to adopt is that known as the Mercury Intensifier, and it has the advantage of being one of the oldest methods which have been applied to the intensification of gelatine plates. It is true that it has had one fault alleged against it, namely, that negatives which have been so treated have been found to be wanting in permanence, and have sometimes become discoloured; but investigation has pretty conclusively proved that where this has occurred the negatives have not been properly washed between the different operations. Undoubtedly, when such precautions are neglected fading will probably result. The process is an extremely simple one, and the necessary preparations very few. To begin with, the negative which is to be intensified must in the first place have been *thoroughly* washed, in order to remove the least trace of fixing solution which might otherwise remain in the film. About two hours' washing in running water in the washing tank which has been described will probably be sufficient to effect this. If, as will probably be the case, the negative has been allowed to dry, it must first of all be soaked in clean water until the film has become thoroughly wet. It should then be placed in the dish which has been reserved for the special purpose of intensifying, and some of the intensifying solution, which has already been prepared, poured over it. It will be understood that the whole of these operations can be performed in actinic light, and, therefore, the change which the plate will now undergo will be clearly seen. It will very soon lose its dark appearance, and gradually assume a white or pinkish colour. This will be more easily observed if the dish in which the operation is performed be a black one. In from three to four minutes the action will probably have proceeded sufficiently far; the solution may, therefore, be carefully poured back into its bottle, as it will last a long time and may be used over and over again. The caution as to its poisonous nature, which has previously been given, should be remembered, and due care taken not to spill or drop any about the table or floor. The negative must then be most thoroughly washed, for upon the effectiveness of this operation the permanence of the negative will in a great measure depend. It should have at least half an hour's washing in running water. At the end of that time it is replaced in the tray, and a weak solution of ammonia (made by adding 15 minims of a 10 per cent. solution of ammonia to 2 oz. of water) poured over the plate. Under its influence the white colour will disappear, and the plate will rapidly darken, ultimately becoming quite black. At this stage the action will have gone sufficiently far, and the plate may be removed from the solution and thoroughly washed under the tap. Upon examining it by transmitted light it will be found to have acquired a considerable accession of density, and will probably be capable of giving a good print. After a thorough washing the operation will be complete, and it may be placed in the rack to dry. The degree of density attained may to some extent be varied by the length of time the plate is allowed to remain in the mercury solution, and by altering the strength of the ammonia bath. If only a slight increase of density is desired, only a few drops of the ammonia solution need be used; if, on the other hand, the negative is very thin and requires considerable strengthening, the proportion of ammonia may be very considerably increased. Various other alkaline solutions may be employed to effect the blackening of the image after bleaching, some photographers preferring to use a few drachms of a saturated solution of sulphite of soda, and where only a little extra density is needed this is to be preferred. In the converse case of a negative requiring a considerable accession of density, equal portions of the two solutions used for compounding the hydroquinone developer may be mixed and applied to the plate after bleaching.

We will now consider the treatment of a negative which is over-dense, and requires to be reduced. There are several methods by which the process known as reduction may be effected, but I shall only describe one. I may, however, mention, that when only very slight reduction is necessary the negative may be sufficiently reduced by allowing it to remain for a short time in an ordinary clearing bath, composed of a pint of saturated solution of alum to which half an ounce of hydrochloric acid has been added. When, however, the negative is very dense, more vigorous treatment will be necessary. Two ounces of water are poured into a clean measure, and about ten drops of a solution of perchloride of iron (of the strength used in pharmacy) added. The negative, if dry, should have been allowed to soak in water, in the manner already described, and is then placed in a tray, and the solution poured over it, and allowed to remain for a few minutes. It is then removed, but no visible change in its appearance will be detected at this stage. It should then be placed in a second tray containing three ounces of water, to which has been added about two drachms of the saturated solution of hypo. The reducing action will at once commence, and the plate must be carefully watched, as the action sometimes proceeds so quickly as to be almost beyond control; in which case over-reduction might ensue, and the negative be spoilt. If, on the other hand, the reducing action proceeds very slowly, a few drops more of the solution of perchloride of iron may be added to the first solution, and the negative re-immersed, and, without washing, again re-transferred to the hypo. solution, when probably the action will proceed. These solutions must be thrown away after use, and the dishes, of course, thoroughly washed. When the reduction has proceeded sufficiently far, the negative is to be removed from the solution and thoroughly washed.

The beginner should make it a rule to take a trial print from every negative with a view to ascertaining its printing qualities, and whether it requires to be either intensified or reduced; and if it does not, it should at once be varnished. If, however, either intensification or reduction be necessary, varnishing must be deferred until those operations have been carried out. The object of varnishing is to protect the film, which, though apparently tough, is very liable to become scratched or stained by contact with the silver paper used in printing. Stains so caused are extremely difficult to remove.

The operation of varnishing a negative is very often a difficult one to a beginner, and as it can only be learnt by practice, he will do well to make his first attempts on some spoilt negatives. The object is to cause the varnish to flow over the entire surface of the plate without forming markings or ridges which might show in the print. Any good negative varnish may be employed. Personally, I prefer Hubbard's, and always use it. The negative to be varnished should first be lightly brushed with the camel-hair brush to remove any adherent dust, and then held over a gas flame until it is just as hot as the hand can bear. The plate should then be held between the thumb and finger of the left hand in as nearly a level position as possible, and a pool of varnish poured in the middle; the plate is then slightly inclined so as to cause the varnish to flow towards and fill up one corner of the plate, and, directly it does so, tilted so that it runs to the next corner, repeating the tilting with a slight rotatory movement until the varnish is made to cover the last corner, when the plate must be tilted vertically, and the excess of varnish allowed to drain back into the bottle. The rotatory motion must be continued at this point in order to avoid the formation of ridges. The plate must then be held over the gas flame or in front of a fire until the varnish sets quite hard, which it will do in a few minutes. The operation, although a difficult one to describe, may easily be acquired with a little practice. Varnishes are now supplied which may be applied to the plate with a camel-hair brush; but such a mode of working is very clumsy, and one which I would not recommend the reader to adopt. The negative, after varnishing, will be ready to print from.

CHAPTER XII.

PRINTING UPON ALBUMENISED PAPER.

Preliminary Considerations—A Good Negative Described—An Album, "Not for Exhibition"—Ready Sensitised Paper—How to Print—Precautions—When to Arrest the Process—"Slipshod" Work—Toning—Fixing—Washing—How to Wash the Prints Effectually without a "Washer"—How to Avoid Blisters—Drying the Prints.

If the reader has carefully followed out the instructions contained in the foregoing chapters, he will probably have succeeded in producing some negatives from which he will be anxious to obtain prints. The negative, of course, is only a means to an end, and, from an artistic point of view, is anything but pretty, all the lights and shades of the view being reversed, those portions which represent the high-lights being dark, the clearer portions of the plate representing the shadows. This being the state of things, the beginner will doubtless experience some embarrassment in forming a correct judgment as to what constitutes a good negative; nor is it, indeed, a less difficult matter to give a lucid definition in a handbook. If at this stage he can obtain the advice of a photographer, such aid will be invaluable to him. Failing that, he should submit his negatives to the Editor of the *Amateur Photographer*, who would, doubtless, put him on the right track. He should also purchase an album, into which he should make it a rule to paste a print from every negative taken, writing underneath it full details of the exposure and development of the plate, the paper used in printing, the toning bath employed, etc. This will prove a most valuable record of progress, and will enable him to see what improvement he makes as his photographic education advances.

But, to be of real educational value, *all prints, whether good, bad, or indifferent,* must take their places in its pages.

Those entering the ranks of photography at the present time have a large number of different printing processes from which to choose; but it is obviously impossible to refer to all of them in detail in the pages of an elementary text-book. I therefore propose to describe but three—namely, silver printing on albumenised paper, silver printing on gelatino-chloride paper, and printing on gelatino-bromide paper. The first two of these are what are termed "printing out" processes—that is to say, the action of light produces a visible image during the process of printing; while the third is what is known as a "development process"; that is to say, the prepared paper requires to be developed after exposure, in order to make the image visible.

I will first deal with printing upon albumenised paper, and the necessary operations may be divided into "printing," "toning," "fixing," and "washing." Some ready-sensitised paper will be required. Let it be purchased from a respectable dealer, for it will be difficult, if not impossible, to obtain good results from cheap paper. If of good quality, it will cost about 10*d.* a sheet, and, for a first experiment, two sheets will be sufficient. If negatives of one size only are to be printed from, it may be purchased cut up to the proper dimensions (in our case half-plate), otherwise the full sheets will be found to measure 22 by 18. It will keep in good condition for some considerable time if properly stored, and kept in a dry place. The way I keep mine is to cut it up to the required size, fold several sheets of stout white blotting paper over it, placing the whole under pressure in a printing-frame away from the light in a drawer.

The dark-room table having been carefully wiped with a clean duster, the printing-frames are laid upon it, and the springs being loosened, and the back removed, a varnished negative is laid inside and allowed to rest upon the rebate. A piece of the sensitised paper is then laid face downward upon the negative, care having been taken to only touch the sensitive surface at the extreme edges, otherwise finger marks would probably show in the finished print. Two or three pieces of stout blotting paper, the exact size of the negative, should be laid on the top, the back of the printing-frame then being closed, and the springs readjusted. A moderate amount of white light may be employed for carrying out the foregoing operation, just enough to comfortably see by; but if sunlight should fall upon the window, a piece of yellow tammy should be temporarily hung up, for although the sensitised paper is far less rapid than a gelatino-bromide dry plate, yet it would rapidly darken if exposed to rays of white light. All the frames having been filled, they will then be ready for the next operation of printing. It will be best not to print in the sun; indeed, unless the negatives are abnormally dense, better results will generally be obtained in diffused light. They should be exposed to light, therefore, by placing them flat upon a window-sill upon which the sun does not shine. As in taking the negative, the duration of the exposure cannot be ascertained by rule. It will vary with the strength of the light and the density of the negative. The actinic power of light varies in England enormously; a negative which will give a good print in ten minutes in diffused light in summer, might require a whole day in winter. The facilities for judging correct exposure are, however, in this case far greater, for the operation may be watched as it proceeds. Supposing the day to be a bright one in either summer, autumn, or spring, the frames may be brought in for inspection after an interval of about ten minutes. The frame is held firmly, and one of the springs gently removed, and the hinged back folded over. The print may then be examined by carefully lifting the pads and paper, taking great care not to shift their position, which would cause a double image, and consequently a blurred print. We shall now see the picture in its proper light and shade, and every delicate detail of the negative will be reproduced in the print. If the printing has gone far enough, the whole of the detail will be visible, and the picture will be of a rich, reddish, chocolate colour. We must, however, not stop the process at this stage, but continue the printing until the shadows look heavy and the detail in them disappears. At this stage, probably, if the negative is a suitable one, the darkest portions of the print will assume a bronzed appearance; when this happens, the print may be removed from the frame, and a fresh piece of paper inserted. Our reason for thus over-printing is that the subsequent operations of toning and fixing considerably reduce the print, and had we stopped the printing at the moment when it *looked best*, we should have had but a poor, weak, faded picture by the time all the subsequent operations were completed. Although printing is a simple operation, it must be performed carefully if good results are to be obtained. Many amateurs seem to think that the duty of looking after the frames may be delegated to any one—a sister, a cousin, or a younger brother; or, indeed, in some cases stick the frame up in a window in the morning, leaving it until they return from business, trusting to chance that the proofs are not over-printed. Such methods will never succeed. It is best to postpone printing operations until a morning or a day can be devoted to the work, in which time a good many prints can be got off. It is better and more economical to print and tone two or three dozen at a time than to do only one or two. It is not absolutely necessary to tone and fix the prints directly they are printed, but it is always better to do so when it is possible, as the results are generally finer. When it is impossible to do this, the prints, previous to toning, should be kept between blotting-paper under pressure in the same way as the unprinted paper. The best negatives for printing in silver are those which are fully exposed and not too dense, but which show a good range of gradation. Silver printing, however, is the most accommodating of processes, and passable results may, by the exercise of a little care, be obtained from inferior negatives. For instance, very thin negatives should have a piece of ground glass placed over the frames during printing, and should be slowly printed in a weak light. Dense negatives, on the contrary, will print better in a strong light, or even in sunshine.

Before proceeding to tone the prints, put all dishes, chemicals, etc., used in developing out of the way, and wipe down the table, for the least contact with foreign matter will ruin the prints.

Take one of the large, deep porcelain dishes, fill it with clean water, and put in the prints one by one, allowing the water to run slowly upon them from the tap. The object of this washing is to remove the unaltered nitrate of silver, which is represented by the white or lighter portions of the print; during this operation, the yellow tammy should be hung in front of the window. The washing water will at first have a very milky appearance, due to the dissolved silver, but in a short time this will disappear. While the prints are washing, the toning bath can be got ready. The dish which we reserved for this operation should be placed upon the table, and half filled with the toning solution, the mode of preparing which was described in the chapter upon chemicals. The amount necessary to tone two sheets of paper will be about 16 oz., in which there should be about 2 drm. of the gold solution—equal to 2 gr. of chloride of gold—one grain of gold being usually sufficient to tone a sheet of paper. The prints having been sufficiently washed, denoted by the water ceasing to present a milky appearance, are placed one by one, face downwards, in the toning solution. Not more than four or five at a time should be toned at first, or it will be found difficult to stop the toning action at the right moment. The prints must not be allowed to remain stationary, or they will tone unevenly, but must be lifted and carefully turned over and over, those at the bottom being placed at the top. Their colour when removed from the washing water was a bright, foxy red, but immersion in the toning bath will gradually turn them through brownish red to purple; when the latter colour is reached, they should be removed from the toning bath and placed in a dish of clean water. When all the prints have been toned, the glass funnel with a filter paper inside is placed in the neck of the bottle which holds the solution, which is allowed to filter back into it. The requisite quantity of gold solution to make up to its original strength (in this case 2 drm.) should then be added, and the bottle put away for future use. It should be kept in a dark place, as light causes its decomposition by precipitating the gold.

The next operation is fixing, but before attempting this make it an invariable rule to wash out and put away the dish used for toning, for it is only by adopting such measures that immunity from stains can be ensured.

The fixing bath consists of a solution of hyposulphite of soda; but in this case it should be freshly mixed, and not made from the stock solution. To prepare it, put 3 oz. of hyposulphite crystals in a clean dish—not that used for fixing negatives—and pour thereon a pint of warm water, adding about 10 drops of liquor ammonia. By the time the crystals have dissolved the solution will be cold. It should not be used warm, or blisters may be caused in the prints, which should be immersed in the solution one by one. Directly they come in contact with the bath they will lose their beautiful colour, and assume a sickly, unpleasant yellowish-red colour. This, however, will pass off as the prints become fixed, and ultimately they will almost regain their original appearance. They should be allowed to remain in the fixing bath for about 12 minutes, being turned over once or twice during that time. The fixing bath may then be poured away, and the dish filled up with water from the tap. Now, silver prints have, not undeservedly, it must be confessed, when we look at the contents of an album, acquired a very bad reputation on account of their fugitive character; but this is in a large degree due to imperfect fixation and insufficient washing after fixation. It is, therefore, absolutely essential in the first place to allow sufficient time in the fixing bath to properly fix the prints, and then to thoroughly free them from the least trace of hyposulphite of soda, and only thorough washing will effect this. If it can be afforded, a "print washer" should be purchased. There are many different patterns to choose from, some of which do their work better than others. Wood's washer is thoroughly efficient and cheap; so also is Tylar's "Whirlpool" washer. It is, however, quite possible to get rid of the hypo. in the prints without resorting to the use of an expensive washer. After pouring away the fixing solution, the dish should be filled up with water, and the prints carefully turned over and over, the dish being then emptied, and the process repeated several times. A brown earthenware pan, about 14 inches in diameter, should be placed on the grid underneath the tap, and filled with water. The prints are transferred from the dish to the pan, and a piece of coarse netting, such as is used for a tennis-net, strained across the top; a piece of india-rubber tube long enough to reach to the bottom of the pan should then be attached to the tap and the water turned on. The water coming in at the bottom will keep the prints in gentle motion, and will prevent them from settling at the bottom of the pan. A couple of hours of such washing will be found sufficient to remove all the hypo.

Minute blisters sometimes occur; these are more frequently found on what is called "double" albumenised paper, which has a more glossy surface than the ordinary. The latter is easier to work, and has quite enough surface for most subjects. As a preventative put a handful of common salt in the *first* washing water after toning. The washing water and the solutions should all be at the same temperature; it is for this reason that I recommend the hypo. to be dissolved in tepid water, as the salt in dissolving considerably lowers the temperature of the water in which it is dissolved. Sometimes changing the print suddenly from the fixing bath to pure water will cause blisters. When this occurs the fixing bath should not be poured away, but water from the tap allowed to run on the prints while they remain in the bath, so as to allow the solution to gradually weaken.

When the prints have been sufficiently washed they should be removed from the washing water and placed on a pad of clean blotting-paper, another pad of paper being put on the top, on which more prints may be placed, so that layers of prints are alternated with layers of blotting-paper. A piece of board and some heavy books should then be placed on the top, and the whole left undisturbed for a few hours, when the prints will dry quite flat. The subsequent operations of trimming and mounting will form the subject matter of another chapter.

CHAPTER XIII.

PRINTING ON GELATINO-CHLORIDE PRINTING-OUT PAPER.

The Process Described—Its Advantages—The Different Makes of Paper—How to Manipulate—Printing—Toning—The "Combined Bath"—Instability of Results—How to Prepare the Bath—Fixing—Surface—How to Make Enamel Prints—Squeegeeing—How to Dry the Prints—Matt-surfaced Prints—How to Obtain—Probable Permanence of the Prints—Severe Tests.

This, the latest development of silver printing, has now become exceedingly popular, and by most amateurs is preferred to the albumenised paper process just described. It possesses one great advantage over the latter process, which is that the surface of the print can be rendered at will either glossy, or "matt," as a surface devoid of glaze is termed. It is also slightly more sensitive, and consequently prints quicker than ordinary albumenised paper; at the same time it is quite as easy to manipulate.

There are several different makes of printing-out paper to be obtained from the dealers; they are all reliable, and the reader will probably succeed equally well with either. The first papers of this kind introduced commercially into this country were Obernetter's rapid printing-out paper and Liesegang's Aristotype; both of these are of German make. Then, under the supervision of Mr. Woodbury, an English firm brought out a similar paper under the title of Celerotype, which was followed later by the Ilford Company with their "printing-out paper."* My advice to the amateur would be to select any one of these papers, and keep to it until perfect results can be easily produced.

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* At the time of going to press the Eastman Company have also issued a similar paper.

So far as the actual printing is concerned, the operations are carried out in precisely the same way as when using ordinary albumenised paper. But gelatino-chloride paper being, as I have said, more sensitive, greater care must be taken, both in filling the frames, and in examining the prints, to avoid degrading the purity of the whites by unduly exposing the paper to the action of light. Negatives which are rather thin will give the best prints, and if the weather is at all damp a piece of india-rubber cloth may be used as a backing instead of the blotting-paper pads previously recommended. The paper will be found to print much quicker than albumenised paper, and the frames will, consequently, require to be more closely watched. Neither will it be necessary to over-print to such an extent as is required when using ordinary albumenised paper, there being less loss in the subsequent operations of toning and fixing. If the prints are to be finished off with a matt surface, they should be less heavily printed than if a glazed surface is desired.

The prints may then be toned, either with a toning bath containing sulphocyanide of ammonium, and subsequently fixed, or the operation of toning and fixing may be performed together by using what is called the "combined bath," which is a toning bath containing sufficient hyposulphite of soda to effect the fixation of the prints at the same time as the process of toning is going on. This latter mode of working is not, however, one that can be recommended to a novice, for unless certain precautions are observed the prints may be liable to fade. This is partly due to the fact that the bath will sometimes continue to tone the prints after all the gold has been exhausted, and, to a novice, this would be perplexing, for such action is due to what is called sulphur toning, and prints so toned are extremely liable to fade. Notwithstanding this weakness, the combined bath, when properly used, gives most beautiful results, and if the bath be not overworked, and if the prints are thoroughly washed after fixing, fading of prints is not very likely to ensue.

When the operations of fixing and toning are to be carried out independently, the toning bath may be made up as follows:—Dissolve 30 gr. of sulphocyanide of ammonium in

16 oz. of water, and add, subsequently, 2 gr. of chloride of gold. The bath should be allowed to stand twenty-four hours before it is used.

The procedure is similar to that laid down for the treatment of albumenised paper. Upon removal from the printing frames, the prints will require to be washed, preliminary to their being placed in the toning solution, in order that the unreduced nitrate of silver may be got rid of. Here a word of caution becomes necessary, for the sensitive surface, being composed of gelatine, is far more tender than the comparatively tough film of an albumen print, and requires, therefore, much more careful handling. The prints should be placed in the washing water one by one, and completely immersed by pressing them below the surface, so that air bubbles may not form on the surface, which would probably cause markings on the finished print. The washing water should be changed several times, or until it ceases to appear milky. The toning bath having been poured into a dish, the prints should be removed from the washing water and placed in the toning solution. Too many prints should not be toned at the same time, as the toning action is sometimes very quick, and it will be difficult to remove the prints before they over-tone. They must also be kept in motion, and not allowed to lie still, or unequal toning would result. The best way to do this is to lift them up and turn them over with a small pair of ebonite forceps, which may be obtained at a dealer's for 6*d.* This is better than dabbling in the solutions, which should always be avoided. When the prints first go in the bath they will turn a rusty brick-red colour, but will soon begin to tone, going through all shades of reddish brown and chocolate to purple. When they reach a tone a little darker than the desired colour they should be at once withdrawn, and transferred to clean water, when they may be washed in the manner described for silver prints. The toning bath, after it has been used, should not be returned to the stock bottle, but should be kept separate, and may be used again, with the addition of a little fresh gold solution, until exhausted. The prints are then transferred to a freshly made hypo. bath, consisting of hyposulphite soda 3 oz., water 10 oz., in which they are allowed to remain for ten minutes, after which they may be placed in the washing tank.

Two hours' washing by the method advocated for albumen prints should be quite sufficient for prints upon gelatino-chloride paper ; if this time is exceeded, the gelatinous film becomes soft, and interferes with the "squeegeeing" process when it is resorted to. After washing, the prints may be either allowed to dry spontaneously, or squeegeed down to polished glass, or ground glass, according to the effect which is desired in the finished print. If allowed to dry without further treatment, a surface a little more glossy than that of an ordinary silver print will be obtained. Squeegeeing to polished glass, or ebonite, will give a fine enamel surface, while squeegeeing to ground glass will produce a matt or dead surface like an engraving. We must bear in mind that we are dealing with a gelatinous, or, in other words, a "gluey" surface, and therefore we must not attempt to dry the prints between blotting-paper, or they would stick together and be spoilt. The method I adopt is to procure a packet of very small pins, and pin each print by its four corners to a flat piece of board—a drawing-board answers the purpose admirably. They should not be interfered with until they are dry, when the pins may be removed, and the prints packed flat under pressure until they are wanted for mounting. When a highly-glazed surface is required, the prints upon removal from the washing water should be placed in an alum bath, composed of a saturated solution of alum 2 oz., water 1 pint, and allowed to remain therein for about ten minutes, after which they should be again washed in several changes of clean water. A piece of very clean polished glass, or ferrotype plate, preferably the latter, which is obtainable at any photographic stores, is then taken, and the print lifted from the washing water, and laid smoothly upon the surface of the plate, picture side downwards; a piece of clean letter paper is then superimposed, and a roller squeegee applied firmly, but lightly, to remove the superfluous water, and ensure contact. The note-paper backing is then carefully removed, and the plate reared up on end in a warm room to dry. Artificial heat must on no account be applied. The prints will detach themselves when they are dry, and will present a very high gloss. If it is desired to mount the glazed prints, the procedure will be slightly different. Squeegee down as above directed, and cut some pieces of black enamel paper (obtainable from Fallowfield & Co.) a quarter of an inch *smaller* than the prints; paste the white side, and stick it carefully on to the *back* of the squeegeed print, leaving a white margin of print all round, about an eighth of an inch deep; squeegee well down, and leave to dry spontaneously. When it is dry the print will fall off the plate. It may then be trimmed and mounted in the ordinary way, the backing preventing any loss of glaze through the paste used in mounting.

I have already referred to a few of the advantages of this process, but it possesses some others which may well be noticed. Not the least of these is its probable permanence, though in this respect it has yet to stand the test of time. Mr. Barker, to whom the credit of first introducing the paper is due, states that prints which had been exposed under glass, to all weathers, for a period of two years, did not show any visible signs of fading or deterioration; and I have prints in my own possession which have been most carelessly kept lying loose in a drawer in my dark-room, exposed to the fumes of both gas and chemicals, but which are, notwithstanding, as bright and fresh as when first printed. These prints were produced on Herr Liesegang's Aristotype paper.

Another advantage is that decent results can often be obtained from negatives which are too thin to yield a good print upon ordinary albumenised paper. To the question of surface I have already adverted, but the paper possesses the additional advantage that almost any effect of colour, ranging from bright red to black, can be obtained, which, in itself, is a matter of some importance to a photographer blessed with artistic proclivities. Upon the whole, therefore, I consider the gelatino-chloride printing-out process the very best that the beginner who wishes to print in silver can take up.

CHAPTER XIV.

BROMIDE PRINTING.

The Advantages of the Process—The Negatives Required—Description of the Process—Working by Artificial Light—Artistic Recommendations—Colour—Surface—History—Commercial Papers—Printed Instructions—Advice—Accuracy of Exposure Essential—How to Obtain Uniformity of Results—Procedure—How to Ascertain Correct Exposure—A Suitable Non-Actinic Light—Development Described—Clearing—Fixing—Washing and Drying the Prints—Printing from Thin Negatives—Result of Error in Exposure—How to Correct Over-exposure—Colour of Prints—Final Caution.

Bromide printing is a process which specially commends itself to the requirements of the amateur, for the reason that better results from injudiciously exposed negatives are obtainable from it than from any other. The finest results are, of course, as with other processes, only obtainable from the most suitable negatives, and it may be well to at once describe the kind of negative which should be aimed at when printing on bromide paper is contemplated. The most suitable negative for the purpose is one that is rather thin—a little less vigorous, in fact, than would be considered necessary for printing on albumenised paper—and it should not show any harsh contrast of light and shade, nor any hard patches of undue density; though really passable prints may be obtained from negatives which are absolutely too thin to print by any other process. In many cases, indeed, when such negatives are obtained, it will be advisable to reserve them for printing from in bromide, rather than resort to intensification, which should be avoided whenever possible. Reasonably good prints may also be obtained from negatives which exhibit the converse conditions to those just described; that is to say, from those which are unduly dense. How the best results may be secured under these varying conditions I shall in the present chapter endeavour to make clear.

Bromide printing is what is known as a development process—that is to say, the image after exposure to light under the negative is not visible as it is when albumenised paper is used, but requires to be developed in order to bring it out. This leads me to refer to a further advantage of the process, namely, that the whole of the necessary operations, including the exposure of the paper, may be carried on at night, independent of the assistance of daylight. This is no small advantage to the amateur, whose time is fully occupied during the day, as it will enable him to produce his prints at night.

From an artistic point of view the process has much to recommend it. In appearance, a properly produced bromide print closely resembles an engraving, its colour being a good black; although, by a subsequent process of toning, this black colour can be easily changed to various shades of red and brown. For this reason the process is preferred by many people (particularly those who profess artistic ideas) to silver printing either on albumenised or gelatino-chloride paper.

Gelatino-bromide paper is manufactured commercially by several firms, but Morgan & Kidd were the first to issue the paper to the public. I have used their paper from the time of its introduction, and do so still, not having met with any which is better. My remarks, however, will apply equally to this particular paper, or to that of any other maker, for, except in the matter of rapidity, there is really very little to choose between the different makes. Whatever paper is selected, the printed directions accompanying it must be most carefully read and studied before any attempt is made to use it, as each different make will require some slight difference in treatment, which, though it may appear trifling, will in reality have a great deal to do with the final results; moreover, it is only fair to the manufacturer, who should know what particular method of working suits his productions best, to obey his instructions. Although the hints which I am giving apply generally to all bromide papers, they are not intended to in any way supersede the printed instructions accompanying the packets.

Accuracy of exposure is of primary importance, and the factors which determine it are the same as in other photographic work. In order to obtain uniform results in this respect it is necessary to observe two precautions: first, always to use the same source and intensity of illumination; and second, always to place the printing frame during exposure at the same distance from the light. Then, when once the correct amount of exposure has been ascertained for a particular negative, a note can be made of the time, in a book kept for the purpose, so that at a future time any number of prints can be produced with ease and certainty.

The source of light may be either gas, oil, or candle, it does not matter which, though on the score of convenience perhaps gas has some advantage. Whichever be employed the light should stand on a mark on the table, or bench, and the printing frame be placed at a given distance from it—two feet is a good average distance. Correct exposure can only be learnt by experiment, but working under the fixed conditions which I have prescribed will render it a tolerably easy matter to ascertain. The quickest and easiest way of finding out the proper amount is to give a graduated exposure to the negative in the manner which I will now describe.

One of the packets of bromide paper is opened in the non-actinic light of the dark-room, and a sheet of the paper laid, coated side down, on the negative in the printing frame; the sensitive side may be known by its tendency to curl inwards; the back of the frame is then replaced, and the frame itself placed at the two-feet mark from the light. All but one-third of the negative should be covered up by a piece of card larger than the frame, the light turned up, and an exposure of say five seconds given, the card is then moved so that two-thirds of the negative is uncovered, ten additional seconds being counted, when the card is completely withdrawn, a further ten seconds being allowed. We shall thus have given three different exposures to the same print, so that, although this print will be valueless from an artistic point of view, we shall be able upon development to see which exposure was most nearly correct

To work bromide paper successfully one must use non-actinic light of a suitable character. The paper is very much less sensitive than an ordinary dry plate, therefore light of a very different character may be employed; ruby light is unsuitable and unnecessary. Good yellow light, and plenty of it, should be used. I find the ordinary yellow fabric sold for about 9*d.* a yard to be the most suitable material to employ. In fact, the light should be such that the print of an ordinary book may be read with comfort by it.

The most suitable developer for bromide prints is the ferrous oxalate. Hydroquinone is recommended by some workers, but it is not one that I can advise the beginner to employ, as with it there is a great tendency to obtain results of a "soot and whitewash" character. The developer, as ordinarily employed, is made by adding one part of the saturated solution of sulphate of iron to six parts of the saturated solution of oxalate of potash (the iron must always be added to the oxalate, or a precipitate would result); but in my own practice I slightly modify this strong developer by adding to it an equal bulk of *distilled* water, my plan being to give a rather full exposure, and develop with a solution well restrained by dilution with water. I have given a great deal of attention to the development of bromide prints, and I have found that this treatment of the paper generally gives the finest results. The image comes up slowly, and density is not acquired so rapidly as when the concentrated developer is used. The development is consequently more under control, and can be more easily arrested when the desired effect is obtained. The gradation of the prints, too, is much better than when the ordinary method is followed

Development is carried out in the same manner as with a plate. The exposed paper is soaked for a few minutes in a porcelain dish filled with clean water. The water is poured off, and the developer flowed over the paper in an even wave. If sufficient solution is used this can easily be done. The great thing is to avoid bubbles; if any form they should be removed with a camel-hair brush. The dish must be rocked so as to cause the developer to flow backwards and forwards over the paper. The development of the image should be gradual, and even if the exposure has been incorrect, with the dilute developer recommended, the image will never rush up, as is sometimes the case when normal solutions are used, unless the exposure has been very excessive. The print should be allowed to develop just a trifle denser than it is required to be when finished, as there is a little reduction of density in fixing. It is important to arrest development at the right moment, and without hesitation. The solution, therefore, must be poured off into the measure promptly, and about 2 oz. of clearing solution, composed of acetic acid ½ oz., water 60 oz., poured over. This will at once arrest development, and will remove any deposit of iron from the pores of the paper. Its use should never be dispensed with, or impurity or yellowness of the whites may result. The prints may remain in the solution about two minutes, when they must be thoroughly washed, to remove all traces of acid, before being transferred to the fixing bath, which should be composed of hyposulphite soda 2 oz., water 10 oz. After two hours of thorough washing they may be removed, and hung up by one corner to dry. The surface being gelatinous, they must not be dried between blotting paper.

In concluding this chapter I will refer to one or two matters of detail which may assist the novice in securing good results.

First, as to exposure: very thin negatives should be printed with a weak light, dense ones with a strong light. Excessive exposure will produce a grey-looking print without contrast; under-exposure will, on the contrary, give very great contrast and an absence of detail. Over-exposed prints may possibly be saved by further diluting the developer with water, and adding one or two drops of a 10 per cent. solution of bromide of potassium. Development is much faster in hot weather than in cold, and the time occupied in developing will have some effect upon the result, for prints which take a long time to develop will appear hard, while those that develop quickly will be soft. The best colour can only be obtained by giving a correct exposure. Perfect freedom from contamination with other chemicals is of primary importance in bromide work; the least trace of hypo. or pyro. would be fatal to good results, and indelible stains would be produced.

CHAPTER XV.

TRIMMING, MOUNTING, AND FINISHING THE PRINTS.

The Necessity for Care in Finishing Prints—A Stumbling-block with Amateurs—Trimming and the Use of the Knife—Improving the Composition by Cutting Down—How to Ascertain whether a Print Requires such Treatment by the Use of Masks—Cutting Knives and Cutting Blocks — Necessary Apparatus — Cutting Glasses—Procedure—Mountants—How to Make Starch Paste—How to Apply it to the Print—How to Mount the Print—Mounting Albumenised Paper Prints—Mounting Bromide Prints —Difference of Treatment — How to Improve the Surface of Bromide Prints—The Selection of the Mount—Simplicity of Treatment Recommended—Vulgarity to be Avoided—Mounts of Good Quality Recommended — Mounting Prints in Optical Contact.

By whatever process the prints may have been produced, they will not be in a fit state for preservation or presentation until they have been suitably trimmed and mounted. Now, although the mounting and finishing of a print would at first sight appear to be an extremely easy operation to perform, as a matter of fact it is one which proves a stumbling-block to a large proportion of amateurs. This is in some measure, no doubt, due to slovenliness or carelessness, though these are not the sole causes. The reader, therefore, from the first, must learn to pay attention to this purely mechanical work, because very much of the effect of the print will be due to the manner in which it has been trimmed and mounted.

In the first place the effect will depend to a large extent upon the amount of subject included in the picture, which may often be improved in its composition by a judicious cutting down or trimming. In ascertaining whether this should be done or not, the employment of a number of cut-out mounts with openings of various sizes, which may be put over the print until the best result is obtained, will be of great assistance. Never be afraid of cutting down the picture if thereby its composition can be improved; recollect that size has nothing to do with merit, and if it is apparent that a half-plate picture will be improved by being reduced to half its dimensions, do not hesitate, but make the necessary reduction.

The size of the print being determined, we may proceed to trim and mount it. Various cutters are sold at the shops, but a good sharp penknife may be used, or an old razor, or, best of all, a knife such as is used by shoemakers for cutting leather. Whichever is used, it should be kept sharp by constantly rubbing on a hone, and not allowing to get blunt, or jagged edges will occur in the print. A drawing board makes a capital cutting-board, and an ebonite straight-edge or T square is better for a cutting edge than the glasses usually sold for the purpose, which are frequently not true. The print being placed in position on the cutting-board with the straight edge upon it, the print should be cut with one stroke of the knife, using just sufficient pressure to effect the purpose. A wooden cutting-board necessarily will not have a very long life, so more pressure than is required should not be used. A sheet of plate glass will be more durable, but it will blunt the cutting-knife sooner than the drawing-board.

Opinions are divided in regard to the choice of a mountant, but on the whole I do not think starch can be beaten for cleanliness and simplicity. It should, however, be properly made and free from lumps. Some kinds of starch are very unsuitable. Glenfield starch is much the best for mounting purposes. To make it, place two teaspoonfuls at the bottom of a gallipot, and make it into a perfectly smooth thick paste with *cold* water, then fill up the pot with *boiling* water, stirring evenly but quickly all the time; continue the stirring for two or three minutes until the starch clears and thickens; it may then be allowed to cool, when it should solidify into a thick jelly. The trimmed print is then placed face downward upon a sheet of clean newspaper, and the starch applied to its back. It may be either brushed or spread by means of a roller squeegee; the latter is the better mode, as any small lumps in the starch are then broken up. Put a small portion of starch in the middle of the back of the print, and pass the squeegee backwards and forwards over the print until its surface is evenly covered, in the same way as printing ink would be applied to a litho stone. Then lift the print carefully by opposite corners taking care to avoid getting any starch on its face, which would cause smears, and lay it down evenly in position on the mount, upon which two small pencil dots should have been previously made as a guide to position. If it is not quite even, it may be easily shifted until it is so. No attempt to rub or press it into contact with the fingers should be made, but a piece of clean blotting paper slightly larger than the print should be laid over it, and a large size roller squeegee —not the one previously used for spreading the starch— should be applied with a moderate degree of pressure over the surface. The blotting paper may then be removed, and the mounted print allowed to dry spontaneously.

Albumenised paper prints are more easily mounted when slightly damp, therefore after trimming and about an hour before mounting they should be placed between a few layers of damp blotting paper. Bromide prints and prints upon gelatino-chloride paper must always be allowed to become thoroughly dry before they are mounted; if mounted damp the surface would be spoilt. With some makes of bromide paper there is an objectionable metallic lustre and too much glaze; this can be easily got rid of, and the print much improved, by rubbing some finely powdered pumice gently over its surface after it has been mounted and allowed to become dry. Prints so treated, if properly developed in the manner I have already indicated, should be almost indistinguishable from platinotypes in colour and appearance.

It is necessary whilst upon this branch of the subject to say a few words upon the selection of the mount, for the effect of the photograph will depend largely upon its suitability to the subject. The reader should visit a photographic exhibition, and note the manner and style in which the various exhibitors mount and frame their pictures; he will notice that, as a general rule, the pictures which have received distinction at the hands of the judges show careful treatment and the exercise of a considerable degree of taste in this direction. The fact is, that careful mounting and framing considerably enhances the attractiveness of a photograph, and at the same time increases the chance of its attracting the attention of the judges.

It will generally be found in choosing mounts that the simpler they are in character and design the better the effect. When the pictures are to be framed I very much doubt whether anything better than a plain cut-out mount, either pure white in colour or of a tint in harmony with the colour of the print, can be chosen. Vulgarity, of all things, should be avoided. Never be persuaded to buy cheap mounts; by that I mean, do not purchase mounts of common quality made up to imitate the more expensive kinds. Let the material be of the best. Avoid mounts with ornamental borders—such decoration in a mount is altogether superfluous, and tends to distract the attention from the picture. Oxford line mounts are also, to my mind, very inartistic, and give even good work a commonplace appearance. Upon the whole, the plate-sunk mount with India tint appears to be the most suitable and effective commercial mount at present made, and the reader will with most subjects be pretty safe in using these. When silver prints are to be mounted in quantity, and with a view to their being preserved for a long time, it becomes important to have some regard to the purity of the mount itself, therefore only a respectable firm should be dealt with and a good price paid.

It is sometimes required to mount a print in optical contact with a piece of glass, and as the process is an easy one, and enables the most brilliant result attainable to be produced, I give the method here. Take the glass upon which the print is to be mounted, and which should be of good quality and free from flaws, and thoroughly clean it by rubbing over it a mixture composed of tripoli ½ oz., liquid ammonia ½ oz., methylated spirit ½ oz., and water 3 oz. Now make a weak solution of gelatine by dissolving 60 gr. in 2 oz. of hot water. Having dusted and warmed the glass, pour a pool of the solution in the centre. The print, which should have been soaking in water for some time previously (in cold water if a gelatino-chloride or bromide print, in warm if an albumenised paper one), should then be placed face down on the centre of the glass, and a roller or flat squeegee passed vigorously backwards and forwards over its back until all the surplus gelatine is expelled. If any small glistening specks appear on the face of the print they will be due to minute air bubbles, and the squeegee should be used again until they disappear. The glass with the mounted print should then be rested in a vertical position until the print is dry. This is the mode in which the oval frames one sees exposed for sale in the shops at the sea-side and other places of public resort are produced. The result is not very artistic, but some of my readers will probably like to know how to produce such prints. The frames are an article of commerce, and can be obtained from any dealer in photographic requisites.

CHAPTER XVI.

PHOTOGRAPHING ARCHITECTURE.

The Utility of the Swing Back—When its Employment is Required—The Legitimate Use of Wide-angle Lenses—Distortion—How to Remedy by the Employment of the Swing Back—Other Uses of the Same—Architectural Work—Its Suitability for Reproduction by Photography—Exterior Views—The Best Conditions of Lighting — The Photographing of Interiors — The Lighting — Halation, How to Mitigate—Edwards' Isochromatic Plates—Backing—Selection of the Point of View—Precautions—Sliding Leg Tripod Necessary—Focussing—Exposing—Development of the Plate—Special Treatment—Weak Solutions.

In the chapter upon the management of the camera no allusion was made to the use of the various mechanical devices with which the camera is fitted, the omission being made in order that the mind of the beginner might not be confused by having too many details presented to him. Therefore it now becomes necessary to describe in some detail the use of the swing-back, the rising front, the reversing back, and the different motions with which the camera is fitted. Now, all these movements are most useful and most likely to be required when subjects of an architectural nature are attempted, and I shall therefore in the present chapter deal with that most interesting and important subject.

We will assume that the reader has packed up his traps, and has arrived at the place which he desires to photograph, which for the sake of illustration we will suppose to be, in the first place, the exterior of a church. He wishes to obtain a general view and to include the nave and the tower, and he finds that the only available position from which he can get an uninterrupted view of the whole building is from the graveyard, which is bounded by a high wall.

The camera is set up and the subject focussed, but upon examining the image on the ground-glass it will probably be found that instead of getting in all the subject we have only a portion of the nave and about half the tower. The foreground occupying the remainder of the plate. This we might overcome by getting further away from the church, but that we are prevented from doing by the high boundary wall. The question arises, how can this difficulty be overcome, and the answer is by the employment of a wide-angle lens. It was in contemplation of such obstacles occurring that in the chapter upon lenses I advised the reader, if purchasing a second lens, to choose one of the wide-angle type. Assuming the advice to have been followed, we unscrew the rapid lens and substitute the wide-angle one. Upon again examining the view on the ground-glass we find that now the whole of the subject appears upon the plate, the battlements of the tower being clearly seen against the sky; but upon more closely examining the picture, we notice that the whole of the building appears to be falling over, and the walls of the tower, instead of being parallel, rapidly converge. What is the reason—is this a defect inherent in the lens? By no means; the fault lies in the adjustment of the camera, the back of which, it will be noted, is not parallel with the building, which it must always be in order to preserve the rectilinearity of the lines in the picture. This might be easily remedied by adjusting the tripod until the back of the camera is plane with the building; but upon again looking at the ground-glass we find that although there is no distortion of the lines, we have, in moving the camera, got an undue amount of foreground in our picture, and completely cut off the top of the tower. The question again arises, Is there any remedy? Fortunately, there is, and it lies in the proper use of the swing back. We have, therefore, to again tilt the camera upward until we get all the subject on the plate, when, of course, distortion again appears. If we now, however, unscrew the milled heads at the side of the camera, and move the swing back until it is parallel with the building, the lines will once more appear free from distortion. But a new difficulty now arises. Before we resorted to the use of the swing back the whole of the picture appeared in fairly good focus; now, however we may manipulate the pinion, we cannot succeed in getting the whole of the picture sharp. The only remedy for this is to insert a smaller stop, and upon doing so we find that the whole of the image becomes sharp. From this experiment we learn that when the swing back is used smaller stops (and consequently a longer exposure) will be required. In the foregoing illustration I have endeavoured to explain in a thoroughly practical manner the use and object of the swing back. Those who may desire to learn more on the subject from a theoretical point of view I must refer to more advanced treatises, such as "Abney's Instructions in Photography," which contains an excellent chapter upon the subject. The swing back is also used for bringing different planes of a picture into better general definition, and is largely so used in photographing portraits in the studio. Such use, however, must necessarily introduce a certain amount of distortion, and is therefore to be deprecated.

There can be no doubt that photography excels more in the reproduction of architecture than in any other branch of the art. It reproduces every intricacy of detail in the beautiful carving which is to be found in some of our cathedrals and churches with a fidelity unattainable by any other means. A day's work in some old cathedral, mansion, or castle gives me the greatest enjoyment, and as many of my readers may possibly share this feeling with me, it may be useful here to give them the benefit of what experience I may possess.

Outdoor work and exterior views present no particular difficulties. *Weak sunlight* will be found to give the best lighting. Diffused light is apt to produce flatness, while very strong sunshine will probably give hard negatives with an absence of detail in cast shadows. An all-over-alike, even lighting should always be avoided, as the beauty of an architectural photograph is largely dependent upon a good contrast of light and shade. The swing back, as I have already observed, will frequently have to be employed, though in some cases it may be possible to dispense with its assistance by raising the rising front, and whenever it is possible this should be done.

The greatest difficulties will occur when the photographing of interiors is attempted, and this, no doubt, is a branch of work which will require some practice before complete success is attained. This work should never be attempted, at any rate by a novice, in any but diffused light, as the great thing to be avoided is undue contrast, and the defect known as halation; a term which has already been defined in the chapter upon "Defects." Let me recommend the reader to use Edwards' isochromatic plates for this work; those of medium sensitiveness are best, as I find there is less halation with them than with ordinary plates; they should, as a further precaution, be backed in the manner I have previously described.

A great deal of the pictorial effect of the photograph will depend upon the careful selection of the point of view. In photographing the nave of a cathedral, which generally makes a pleasing picture, care should be taken to avoid placing the camera quite centrally in the aisle; it should be placed either to the right or the left so as to show one row of pillars in profile as it were. Care should also be taken to avoid, as far as possible, objects such as pews, etc., obtruding themselves in the immediate foreground, which would tend to give an effect of exaggerated perspective to the view. A sliding or adjustable leg tripod is almost indispensable in this sort of work, and the precaution should be taken to stick the iron shoes well into three good bungs, which will prevent injury to the floor, and the tripod from slipping on a stone floor. It is sometimes very difficult to focus accurately, owing to the dimness of the light. I find the best plan, when the image on the screen is too dark to focus in the ordinary way, and when taking general views, is to focus on a window, and then to give the milled head a slight turn, moving the pinion perhaps the 1-16th of an inch forward, so as to lengthen the focus and get objects in the foreground sharper. It is best to use a rather small stop, say *f*/32, as good definition is imperative in this class of work, and give a full exposure. The duration of the exposure will, of course, depend upon the amount of light, and no rule can be laid down. In photographing dark interiors, however, it is difficult to over-expose. It is far better to err upon the side of over- than under-exposure. The former can be remedied, the latter cannot—an under-exposed interior should be consigned to the dust-heap. My own practice is to give the fullest possible exposure, and develop very slowly, and with a very weak developer. As I have said, undue contrast is generally the most difficult thing to avoid, and the only way to successfully overcome it is to work on the system I have indicated. I compound my developer somewhat as follows, varying it, of course, according to the nature of the subject. Pyro. is the best reducing agent to employ for this class of work, hydroquinone the worst. To make 2 oz. of developer I put 20 minims of the pyro. solution, 10 minims of bromide solution, and 10 of ammonia in a measure, making the bulk up to 2 oz. with water. This developer, weak in all its constituents, is then applied to the plate. Time must be allowed, for although the exposure has been full, the action of this solution will be slow. In about five or six minutes the high lights, represented by the windows, will begin to appear. At this stage about 5 minims of ammonia solution should be added, and the solution re-applied. The image will now slowly gain in strength and detail, and after the developer has acted upon it for about ten minutes, the plate may be removed and examined. We shall probably find that we have a negative full of the most exquisite detail, but thin and lacking in density. This is what we aimed at, and is an indication of success. The developer is poured off, and a fresh one mixed as follows: Pyro. 40 minims, bromide 30 minims, ammonia 30 minims, water 2 oz. This is then applied to the plate, which, under its influence, will rapidly acquire density. Sometimes sufficient density is obtained with the weak developer, in which case it will not be necessary to apply the strong solution. The *rationale* of this system is to bring out all possible detail without producing undue density, and then to strengthen the weak image by the application of a normal solution, or one strong in pyro.

CHAPTER XVII.

PORTRAITURE.

Amateur Portraiture — Practical and Technical Difficulties — The Studio—A Few Hints on Lighting the Sitter—Outdoor Portraiture — What to Avoid — Background, etc.—The Lens and Plate—Sitting-room Portraiture—Choice of the Room—Aspect —The Position of the Sitter in Relation to the Light—Screens and Diffusers—Suggestions on Posing—What to Avoid—Exposure—Development.

In writing for amateurs upon the subject of portraiture I am strongly inclined to repeat the oft-quoted advice given by *Punch* to those about to marry, and say "Don't," only that I feel it will have but little influence upon the majority of my readers. The first thing the possessor of a lens and camera sets his mad ambition upon is the taking of portraits, notwithstanding that to be a successful portraitist demands perhaps more skill and artistic ability than any other department of photography. Not only is this so, but the practical and technical difficulties in the way of the ordinary amateur are very great; for instance, in order to secure good results it is almost indispensable that the photographs should be taken in a properly constructed studio, a condition beyond the reach of most amateurs. Of course, good work, nay, work of the highest class, *may* be produced without the aid of a studio; but to do so demands the possession of no inconsiderable skill and knowledge upon the part of the operator.

We are all acquainted with the atrocious monstrosities, yclept "portraits," of the amateur photographer, and it is with a view of preventing our friends from producing, through ignorance of the principles, similar unsatisfactory results, that this chapter has been written, though, for the reason above stated, it will be but seldom that results comparable with professional work can be produced.

The first and most important point to be considered is the lighting of the sitter, and we shall probably have to choose between taking the photograph out of doors, or in an ordinary room.

Generally speaking, if a little trouble be taken, better results, from an artistic point of view, will be obtained indoors than out. The defects of each system, however, will be of an entirely different character. In working out of doors the difficulty is to avoid flatness, and want of relief, owing to the evenness of the lighting. On the other hand, portraits taken indoors very frequently show an undue amount of contrast, the lights being hard and the shadows dense. I will first deal with outdoor work, though the advice which I shall offer upon posing, and the arrangement of the sitter, will apply equally to either mode of working. A portrait should never be taken in direct sunlight; either a dull day should be chosen, or the sitter should be placed in the shade. In order to avoid heavy shadows under the eyes, nose, and under-lip, which tend to destroy likeness, and apparently age the sitter, a piece of thin muslin should be suspended over the chair in which he or she is placed, in order to diffuse the light. It would be well, too, if the light appear to fall evenly on both sides of the sitter, either to place the chair about three feet from a high wall or put an opaque screen at about the same distance on one side, so that one side of the face may be thrown partly in shadow, and the necessary relief secured. If circumstances are favourable, a natural background, such as an ivy-clad wall, may be employed, though in most cases an artificial one will be more suitable. A plain grey or neutral-tinted graduated background, mounted like a map on a roller, may be purchased for a few shillings, and if the reader intends to devote his attention seriously to portrait work he should make the outlay. Backgrounds with terraces, pillars, festoons of flowers, and other eccentricities of the artist, should be carefully avoided, and a perfectly plain one selected. A rapid rectilinear lens should be used, and its focus should be at least one and a half times the length of the base line of the plate, for if one of shorter focus be employed, distortion may result. In order to avoid the chance of movement the exposure should be as brief as possible, therefore a smaller stop than $f/8$ or $f/11$ need not be used. For the same reason a moderately quick plate should be chosen, and its development may be effected with the normal developer given in the chapter dealing with the development of the plate.

Sitting-room portraiture requires a little careful consideration and arrangement of the resources at command, in order to secure the best results. Naturally, some rooms are better adapted for the purpose than others. The aspect is, of course, important. A room with windows facing north, or north-east, will be easiest to manage. If the aspect be south, or south-west, portraiture cannot be indulged in while the direct sunlight is falling upon the windows. A broad room with two windows will afford the best conditions, for if the room be narrow, owing to the short distance between the camera and the sitter, the use of a short focus lens becomes necessary. We will assume that a room such as is shown in the rough ground plan in fig. 23 is available,

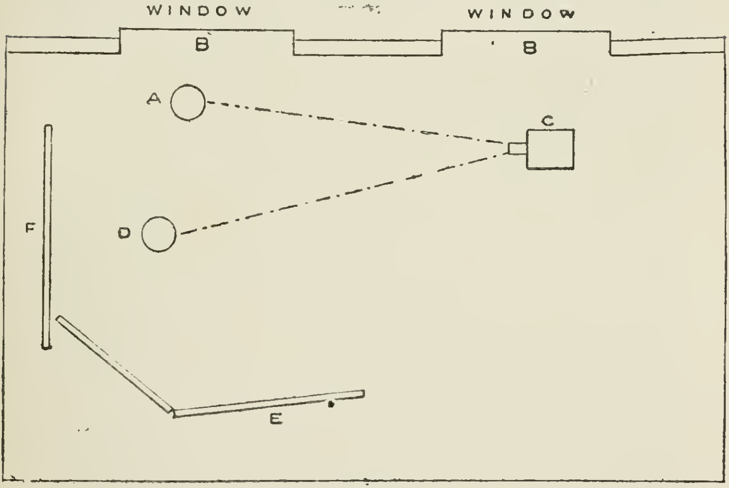

FIG. 23.

and that the camera is placed at C. Now the first impulse of the novice will, doubtless, be to place the sitter as near to the window at A as possible, in order to utilise all the available light. This, however, would be a great mistake, and will account for a great many failures. The difficulty with the lighting in sitting-room portraiture is not because there is an insufficient amount, but rather on account of the unsuitable manner in which it is admitted. The nearer the sitter is placed to the window the greater will be the contrast of light and shade in the photograph. Therefore, the chair should be placed about five feet from the window at the point marked D, the camera remaining in the same position. A marked improvement in the lighting will be manifest, although the shadow side of the face will probably still be too dark. To obviate this defect a clothes-horse, or a screen, should be placed at E, about 4 ft. from the sitter, and a white tablecloth, or a sheet, thrown over it, which will have the effect of further softening and lighting up the shadows. If the light be very brilliant, it may with advantage be subdued by hanging in front of the window a strip of *very fine* muslin. The foregoing observations on the choice of lenses apply equally to sitting-room portraiture, though if great rapidity of exposure is necessary, a portrait lens may be substituted for the rectilinear, though the latter is to be preferred. For this class of work a rapid plate may be used with advantage.

In regard to posing, little can be said in an elementary text-book. In the first place, try and secure an easy and natural expression by putting the sitter, as far as possible, at ease. Let the chair in which he sits, if the portrait be a sitting figure, be easy and comfortable. The use of a head-rest should be avoided, as in most cases it results in introducing an unnatural stiffness into the portrait. If the subject is so shaky as to render it impossible to take the portrait without its aid, my advice would be not to make the attempt. Avoid all theatrical or stagey attitudes. Simplicity and naturalness are the great points at which to aim. A more artistic result will often be obtained if the sitter is allowed to be engaged in some ordinary occupation such as reading or writing, but in such cases too many accessories should not be introduced into the picture. If, however, a portrait pure and simple, or a "head and shoulder" study is desired, great attention must be paid to the pose. In the first place, the camera must be levelled, and in a line with the head of the sitter, neither pointing up nor down, for in the first case the chin and jaw would probably be unduly accentuated, and in the latter the forehead would appear abnormally large. The head should be erect and nicely balanced on the shoulders; if it were allowed to droop, the effect would be the same as if the camera were tilted. The sitter should never be allowed to stare into the lens, but should give his head a half-turn towards the direction of the light. It is said, and I believe with some truth, that with most individuals one side of the face is better than the other. I should say here, that if the room have two windows, the one near the camera should have the blind drawn down, or uneven lighting may result. The advantage of having the two windows is that the sitter may be placed in front of either, and thus the best side of the face portrayed.

I will conclude this chapter by giving a few hints upon the development of portrait negatives taken in a sitting-room. The great difficulty, as I have said, is to avoid undue contrast; therefore the exposure should be as full as possible, and the plate a quick one, for the beginner will generally find that it is more difficult to get density on very rapid plates than on slow ones. Hydroquinone, on account of its tendency to give contrast, should never be used for this class of work. Pyro. will be found to give the best results. A smaller quantity, however, may be used than that recommended in the chapter on development for landscape work. The following proportions will generally be found to give good results:—

Pyro., 20 minims, equal to 2 gr.	Ammonia, 30 minims.
Bromide, 20 ,,	Water, 2 oz.

The above developer is, of course, to be made from the 10 per cent. stock solutions already described. If the exposure has been correct the image should begin to appear in about two minutes, and if upon examination during development it appears likely to become too dense, the developer may be further diluted by adding half an ounce of water. If the plate be under-exposed, it should be rejected and a fresh exposure made.

CHAPTER XVIII.

ENLARGING BY DAYLIGHT.

Choice of Method—Daylight Preferable—General Principles—Apparatus Required—How to Enlarge in an Ordinary Room—The Lens—Getting Ready for Work—Procedure—How to Determine the Correct Exposure—Development—The Best Negatives for Enlarging—The Use of a Reflector, etc.

The amateur who contents himself with working a small-sized plate will probably be anxious to learn how to make enlargements from his small negatives, and as the process is one which presents little difficulty, I propose to devote a chapter to its consideration. Enlargements may be effected either by day or artificial light, but as the latter method involves the use of apparatus of a rather costly nature when half-plate or larger negatives are to be enlarged from, I intend to confine my attention to what is known as the "daylight method." The procedure is very simple, and consists in so placing the negative that the whole extent of its surface shall be evenly illuminated, as at A in fig. 24. An ordinary lens is suitably supported at B, by means of which an enlarged image of the negative is projected upon the screen C. The size of the enlargement will depend upon the distance at which the lens is placed from the negative to be enlarged; the nearer the former be placed to the latter, the greater will be the amplification.

Very little in the way of additional apparatus will be required, and as probably very few of my readers will care to go to the expense of purchasing a properly constructed enlarging apparatus, I will describe briefly how the necessary operations may be carried out in an ordinary room. An apartment at the top of the house should be chosen, and if the window faces north so much the better, as the sun's rays will not then interrupt work by casting shadows upon the negative and causing uneven lighting. The first thing to be done is to block out all light except that which passes through the negative, and the best way of effecting this is to make a frame the exact size of the window, which should then have a piece of calico tacked over it, which in turn should be pasted over with thick carpet paper. This when dry will be quite light-proof and as tight as a drum. The frame can be fitted up to the window or taken down at a moment's notice, so that this arrangement may be used in any bedroom or apartment in the upper part of the house, without causing any serious disturbance of existing arrangements. An opening about 9 in. square should now be cut at CCCC (fig. 25), into which a light carrier D, with a rebate to take half-plate negatives, is to be fitted. This carrier may be easily secured to the brown-paper frame by gluing it to the opening with strips of stout paper. Two small brass clips at EE will hold the negative in position. We have thus provided for condition number one, for when we have placed the frame and negative in position we shall have so arranged matters that the light is excluded from the room at the same time that the negative is evenly and brightly illuminated. A firm table is placed underneath and close up to the window. A suitable support must now

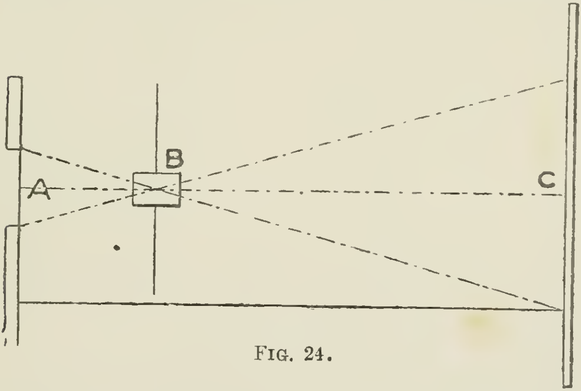

Fig. 24.

be devised for the lens; at the same time provision must be made for the exclusion of light between it and the negative. For this purpose the camera in ordinary use may be utilised. The lens having been screwed on, and the reversing back removed, the camera is placed on a box or other suitable support, in the position shown at A in fig. 26, close up against the negative. The only thing that remains to be done is to place a drawing-board, which has previously been covered with white paper, in a vertical position on the table at B. Such an arrangement, although extremely simple and inexpensive, will enable the amateur worker to produce bromide enlargements of the highest excellence; indeed, some of the finest work of this class that I have ever seen has been produced under precisely similar conditions to those described. The most important point demanding attention is to see that all the separate parts of the arrangement are strictly parallel with each other; the camera must be close up to and square with the negative, and the drawing-board, upon which the enlarged image is received, must also be accurately parallel with the negative, as any disarrangement of the relative parts would cause a want of definition in the enlargement.

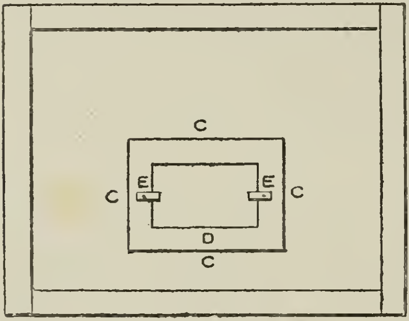

Fig. 25.

A rapid rectilinear is the best lens to employ, though if the reader does not possess one, any other kind may be used—single, wide-angle, or portrait. He will generally be safe in using the lens with which the negative was taken, and if he has but one lens, and the advice previously given has been followed, that will be a rapid rectilinear.

The manner in which the apparatus is to be used is sufficiently obvious. The apparatus having been set up, the actual procedure is very simple. The negative to be enlarged is placed in the rebated groove, and the buttons turned to prevent it from falling out. The lens and camera being placed in position, the enlarged image will then fall upon the drawing-board. Its size, as I have already pointed out, will be determined by the distance at which the lens is placed from the negative. In the *Dictionary of Photography* will be found a very useful table giving the distances at which the lens should be placed from the negative for lenses of different focal length; a reference to which will save much trouble in effecting the rough adjustment. The final focussing of the enlarged image is effected either by moving the pinion of the camera, or by shifting the drawing-board backwards and forwards until the image is quite sharp. If the lens be a good one there should be no necessity to stop it down to any considerable extent; *f*/16 should be quite sufficient, and it must be recollected that stopping down will considerably increase the duration of the exposure. The image having been sharply focussed and the lens capped, a piece of bromide paper is removed from its packet and secured to the drawing-board by means of drawing-pins. The exposure may now be given, but its duration will depend upon a variety of circumstances—the density of the negative, the strength of the light, the aperture of the lens, the rapidity of the bromide paper, and a variety of other factors, all of which must be ascertained before any reliable advice can be given. The easiest and most practical way of finding out the correct exposure, although it is only a "rule-of-thumb" method, is to cut up one of the pieces of bromide

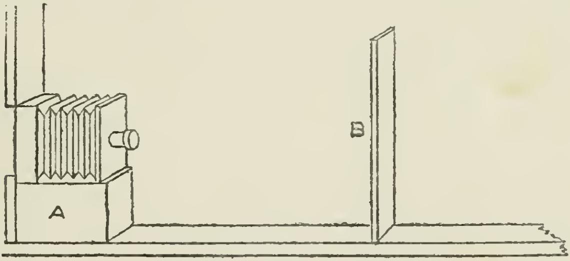

FIG. 26.

paper into twelve strips, pin one of these on the centre of the drawing-board, covering all but three-quarters of it with a piece of card, now uncap the lens and give an exposure of say ten seconds; recap the lens, push the card so that it covers half the paper, and give another five seconds exposure; repeat the operation a third and a fourth time, so that the strip of paper will have received four different exposures. It should then be developed, when its behaviour will soon determine which exposure was most correct.

In regard to development little need be said, for the instructions given in the preceding chapter on bromide printing apply equally to the development of enlargements. The reader should implicitly follow the directions for the mixing of the solutions, etc., as the modified developer recommended will be found easier to manage, and will give better results than the strong solutions usually employed.

A good and sharp negative will bear enlarging several diameters without any very perceptible loss of definition, but a negative which is wanting in sharpness will not give a good enlargement. Soft and rather thin negatives are the best for enlarging; dense ones do not enlarge well. Therefore if the negatives are intended for enlarging, some attention should be paid to these matters at the time of exposure and during development, so that a suitable negative may be obtained.

Sometimes it is not possible to secure a room with a window facing north, and the view from which is not obstructed. In such a case it will be necessary to use a reflector. This need not be a mirror, which would be costly, but may be made of thin boards neatly joined, and painted with a dull white paint. It should be fitted outside the window at an angle of 45° with the negative. Working with a reflector obviates any difficulty with objects opposite the window, such as houses, trees, etc., only reflected light from the sky being utilised.

CHAPTER XIX.

MAKING LANTERN SLIDES.

A Retrospect—Commercial Lantern Plates—Quality—Alternative Methods — Contact Printing — Chloride Plates — Procedure — Exposure by Magnesium—Development with Ferrous Oxalate —Cleanliness—The Attributes of a Good Slide—Fixing—A Fresh Fixing Bath Essential—Drying—Mounting—Binding and Finishing—Concluding Words.

When I first commenced the practice of photography the number of amateurs who made their own lantern slides might almost be counted upon the fingers of one hand. Since then photographic operations have been almost revolutionised, and, owing to the substitution of gelatine for collodion, and the introduction of commercial dry plates specially prepared for the purpose, nearly every amateur photographer nowadays tries to make his own lantern slides. Nor can anything be said against the practice, for although at first the results may not be equal to those produced by professional slide-makers, yet the very fact of their being the worker's own production at once gives them a value which the best commercial slides would necessarily lack.

English lantern slides measure $3\frac{1}{4}$ by $3\frac{1}{4}$ in., and plates of that size, coated with emulsions prepared specially for transparency work, can be obtained from any dealer; for nearly all the well-known plate makers also make and sell lantern plates. I cannot undertake to recommend particular brands; I have used, at one time and another, every known make, and the general quality is so good that I believe it is possible to obtain, with a little practice, equally good results upon any of them. The beginner should select one particular make, and stick to it until he is able to produce a passable slide.

There are two ways of making lantern slides, namely, by contact printing, and by reducing in the camera. I shall, however, here only deal with the former method of working.

There are two kinds of gelatine lantern plates made, some being coated with bromide of silver emulsion, and others with chloride of silver emulsion. The former are considerably quicker than the latter, but for contact printing this is no particular advantage, and therefore I recommend the novice to make his first experiments in lantern slide making on chloride plates. A box of these, therefore, should be procured. The plates being very slow, are not nearly so easily affected by exposure to light, therefore plenty of illumination can be used; indeed, the one thickness of the yellow fabric recommended for bromide printing will be found to afford a perfectly safe light. Upon opening the packet the novice will probably have some difficulty in determining which is the coated side of the glass, the emulsion being of an exceedingly transparent character. If, however, the finger nail be cautiously rubbed on the extreme corner of the plate, the coated side will be detected immediately, or the tip of the finger may be moistened, when the tacky nature of the gelatinous surface will be at once revealed. The negative from which the slide is to be made is placed in an ordinary printing frame, one of the lantern plates carefully superimposed, and the back of the frame closed. This leads one to refer to the single disadvantage of making lantern slides by contact, namely, that if the negatives be of larger dimensions than the slide, the whole of the composition cannot be included. It is better, therefore, when the negatives are produced with the special object of obtaining from them lantern slides by contact, to make them on quarter-plates. At the same time, it is often possible to pick out portions of larger negatives which will give good results. Care must be taken, however, when the negative is larger than the slide, in placing the lantern plate in position, to avoid scratching the surface of the negative.

We now come to the question of exposure, and for this particular work artificial light has many advantages. The source of light may be a gas or lamp flame, but magnesium ribbon will be better than either. By observing the precautions recommended for securing uniformity in results laid down in the chapter upon bromide printing, as to keeping the source of light at a fixed distance from the printing frame, uniform results upon chloride plates can be easily secured. When the correct exposure for a particular negative has been ascertained a note of it should be kept. As the plates of different manufacturers necessarily vary somewhat in rapidity, it is useless to specify any particular exposure; but as a rough guide about 3 in of magnesium ribbon, burnt at a distance of 15 in from the negative should give, with a negative of good printing quality, a proper exposed slide; dense negatives, of course, will require more, and thin ones, less exposure. The strip of magnesium ribbon, it is, perpaps, unnecessary to say, should not be held in the fingers, but nipped with a pair of ordinary pliers; the quantity used should be measured and not guessed.

Either ferrous-oxalate or hydroquinone development may be used, but I decidedly prefer the former for developing chloride plates. But whichever is employed some modification of the original formula will be necessary, as the solutions used for developing negatives will prove far too strong for developing chloride lantern plates.

To make the developer, place in a clean developing cup,

Oxalate solution	4 parts.
Iron solution	1 part.
Water, distilled	12 parts.

In using this developer the greatest care must be taken to avoid the slightest contamination with hypo. or pyro., which would be fatal to good results. If the exposure has been correct, the picture will soon begin to appear, and will gain rapidly in strength and detail. The plate must be removed from the developer as soon as the picture is fully out, as the image will continue to gain in density even after it has been placed in the washing water. Density is ascertained by removing the plate from the dish and holding it up to the light of the lamp. At the close of development the high lights, represented by the white portions of the picture, should remain clear; if they become discoloured, the exposure has been excessive, or development has been carried too far. In either case the slide should be rejected, as it is of the utmost importance that the high lights of a lantern slide should be transparent and free from the slightest veiling or discoloration. After washing in running water, the plate should be transferred to a freshly-made fixing bath of ordinary strength. These plates fix very quickly, but they should be allowed to remain in the bath for about ten minutes, after which they must be washed in running water for two hours. They may then be removed, and put on end against a wall in a place free from dust until they are thoroughly dry.

The slides will then be ready for mounting. Some narrow strips of ready-gummed paper, called in technical language "binding strips," should be purchased from a dealer, together with some cover glasses, which are simply plain pieces of glass the size of a lantern plate. Some "masks," as the discs of opaque paper $3\frac{1}{4}$ by $3\frac{1}{4}$ square with various sized openings punched in them are called, will also be required. The size and shape of the opening chosen for any particular slide must be left to the taste and judgment of the reader; but as a general rule oblong openings will be found to yield the most artistic results, and circles should whenever possible be avoided.

To mount the slide, a suitable mask is taken and laid upon the face of the slide, a clean cover-glass is then superimposed, so that the film of the slide is entirely protected from any injury, short of actual fracture. A strip of the gummed binding paper is cut into $3\frac{1}{4}$ in. lengths and moistened. On one of these moistened strips the slide with its covering glass is pressed; it will adhere, and the sides should then be quickly and neatly pressed to the glass. The operation is repeated with the remaining three sides, when the slide will be complete. In order that a lantern slide may appear correctly on the screen, it is necessary to place it in the lantern *upside down*, and with the *film side of the slide towards the condenser*; and so that mistakes in this respect may not occur, it is usual to place some distinguishing mark upon the slide. This usually takes the form of two discs of paper, which should be gummed to the top corners of the slide, when it is held up to the light, and the view appears in its proper position to the observer. In exhibiting, the slides are always inserted in the lantern with these dots down and towards the condenser.

To properly treat the subject of lantern slides it would be necessary to go into far greater detail than would be permissible in these pages; therefore I have contented myself with describing the simplest method of producing them, and the easiest process by which they may be produced. Having succeeded in producing successful results by the simple process described, the worker can try his hand at the reduction method, and can experiment with different makes of plates. Full instructions for producing lantern slides by all the most suitable processes will be found in "The Lantern-slide Manual."*

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* "The Lantern-slide Manual," by J. A. Hodges (Hazell, Watson, & Viney, Ld., 2*s.*, bound in cloth).

CHAPTER XX.

SHUTTER EXPOSURES.

Popular Ideas—Time Exposures Preferable to Shutter Exposures—Necessary Conditions—Shutters—Advantages of the "Blind" Type—The Lens—Apertures—The Plate—Subjects—Necessary Precautions—Actual Work—Sunlight *versus* Diffused Light—View Finders—Development—The Writer's Plan Described—Plain Pyro. Preferable—The Preliminary Bath—Procedure—Errors to Avoid—The "Tentative" Plan—How to Prevent Staining the Film—Detective Cameras—Advice.

With the non-photographic public the impression seems to prevail that all photographs are now taken by what is termed the "instantaneous process." I am constantly being asked whether I am using the "instantaneous process," and when I reply in the negative, I often fancy I can detect a look of incredulity in the face of my questioner. I would at once say that when possible I prefer to give a time exposure, and I would strongly recommend the beginner to adopt the same system, and at any rate not attempt shutter work until he is able to produce good negatives from time exposures. Of course, there are occasions when the use of a shutter is imperative; but, on the other hand, it is often used when there is no necessity for its employment, and when a better result would be achieved by giving a time exposure. Shutter exposures, if successful work is looked for, should only be attempted, at any rate by the tyro, under favourable conditions. The light must be good, the lens must be rapid, and the plate rapid also. It should be borne in mind too that in shutter work everything is, so to speak, strained—the lens, the plate, and the developer.

The first matter to receive consideration is, naturally, the so-called instantaneous shutter. The number of shutters which have been invented, and the ingenuity which has been expended upon their construction, are matters which must excite the wonder of even the most superficial observer, and it is very far from being my intention to attempt an even brief account of shutters in general. Many of them are exceedingly ingenious from a mechanical point of view, but altogether useless for the purpose of the practical photographer. The manufacturers of detective cameras are at the present day vying with one another in a mad race after rapidity, with the result that from a *practical* point of view many shutters are far too quick for the plates. Except for scientific work, and under exceptional circumstances, extreme rapidity is not necessary; indeed, the shutter should always be set at the lowest speed which the movement of the subject will permit. For general work of this class an elaborate instrument is by no means necessary. I shall doubtless surprise many of my readers when I state that nearly all my own rapid work is done with a blind-shutter, costing but a few shillings, and actuated simply by pulling a cord. With it I find it quite possible to give exposures of less than the 1-30th part of a second, and for artistic photography it is seldom necessary to give so high a speed. I find I can successfully take with it such subjects as boats sailing, groups of moving figures, animal studies, etc., though no doubt if I attempted to secure photographs of galloping horses, flying bullets, express trains, etc., it would be found wanting. But except as scientific records such photographs are without value, and as the means of obtaining them scarcely comes within the scope of an elementary text-book, I do not propose to further discuss the subject here. For cloud effects the blind shutter is particularly adapted, as the sky receives less exposure than the foreground, so that in many cases it is possible to secure a good sky effect and a properly-exposed landscape in the same negative. I have, therefore, no hesitation in recommending the beginner who wishes to try his hand at shutter exposures to purchase one of these simple shutters, or if he prefer to have a more costly instrument he cannot do better than buy one of the Kershaw pattern.

The next matter to which attention should be directed is the lens. This should be of the rapid rectilinear form, and, at any rate until some experience in developing shutter-exposed plates has been gained, it should not be worked at a less aperture than *f*/11, unless the light happen to be exceptionally good.

The plate remains to be considered, and its selection is a most important matter. Hitherto I have recommended the reader—at any rate, for general purposes—to use a plate of medium rapidity, and even for the work now under consideration I do not advise the beginner to select the most rapid plates obtainable. For the kind of subjects which we are contemplating—animals, river or sea views, with moving boats, etc., groups of people, and so on—a plate of medium rapidity should be selected. It will be found sufficiently quick for the purpose, and will be far more easy to work than the ultra rapid kinds, which require no inconsiderable skill on the part of the operator to produce really good negatives upon. If quick plates are used, they should not be exposed to the light of the dark-room for a longer period than is absolutely necessary, for not only will they be more easily affected by the light, but an amount of light fogging that would be inappreciable on a plate which had received a time exposure might quite spoil a shutter-exposed one.

If failures from insufficient exposure are to be avoided, shutter exposures should only be attempted in a suitable light. The most favourable time of the year is in the month of June, when the light is at its best. Strong sunshine does not always give the best results, for if the sun be behind the camera, flatness generally results, and if it be to the right or left, the cast shadows are sometimes very heavy; and negatives taken under such conditions—that is to say, showing strongly marked contrasts of light and shade—are very difficult to develop successfully, because the brilliantly-lighted portions of the picture develop up quickly and attain an undue amount of density before the detail can be brought out in the shadows, and a hard and crude print is very often the result. There are many days when the light is very bright and actinic, although the sun may not be actually shining, and such occasions will be found best for this kind of work Days when heavy masses of white cloud are floating about, and at times partially obscuring the brilliancy of the sun, are also very suitable, particularly when marine or river work is being undertaken. The nearer the moving object is to the camera, the quicker the exposure that will be necessary, and in order that the photographer may know the proper moment at which to make the exposure, a "finder" should be attached to the camera. The simplest and best form is that known as the "Aptus," which consists of an ordinary bi-concave lens mounted in a light frame. The image can always be distinctly seen in this form of finder, whereas with the box, or camera obscura form, it is difficult to see the image if the light be bright. Many good effects are lost, or at any rate marred, by indecision in making the exposure. "He who hesitates is lost" should certainly be the maxim of the photographer, and directly the desired composition or effect is seen reflected in the finder the exposure should be made without further delay.

The development of a plate which has received a very brief shutter exposure is naturally a more difficult matter than the development of one to which an approximately correct time exposure has been given, and in order to get the best results some modification of the developer will be necessary. The method I adopt (and I find it succeeds well with most plates) is to soak the plate in a weak alkaline solution previous to applying the developer. I measure out 20 minims of the 10 per cent. solution of ammonia, and place it in a clean measure, adding 2 ounces of water. After stirring the solution I pour it over the plate, and allow it to soak therein for about ten minutes, the dish being covered with a piece of cardboard. I prefer to use for this kind of work a plain pyro. developer, for I find it gives better gradation and more detail than one containing a preservative. Three grains of *dry pyro.* should be placed in the measure and dissolved in 2 oz. of water, 20 minims of the 10 per cent. ammonia solution, and 20 minims of the 10 per cent. bromide solution being added. The developer should be thoroughly mixed by stirring, and (the weak alkaline solution in which it has been soaking having been thrown away) applied to the plate. Now the secret of success in developing negatives which have received shutter exposures is patience. The first impulse will be to put a lot of accelerator in the developer with a view of forcing out the image. This, however, would be a great mistake, and the tentative or gradual system of development should not be departed from. The plate should be gently rocked in order to prevent the formation of a mottled appearance on the negative, which is liable to occur if the developer be not kept in motion.

In about three to five minutes the image should appear, and development should be allowed to proceed as far as possible without adding more ammonia. If, however, the image does not gain in detail, 10 minims of ammonia and 5 minims of bromide may be added. The solution during this time will have become more or less dark in colour, and will to some extent stain the negative; if it becomes very dirty, a fresh developer of the same strength should be mixed, and before applying it the plate should be rinsed under the tap. If development flags, cautious additions of ammonia may be made from time to time with half the quantity of bromide; but the point to be observed is to allow each addition sufficient time to do its work. In some cases it may take half an hour, or even longer to develop a shutter-exposed plate.

Beginners are sometimes recommended to commence with a detective camera, and, unfortunately for photography and for themselves, they frequently follow the advice. A detective camera in the hands of a novice is both a delusion and a snare. I have met a great many amateurs who have commenced in this way, but I have met with few who, unaided, have succeeded in producing even passable results. The truth is that successful work with a detective camera is not such an easy thing as it looks, and it requires no inconsiderable practice and knowledge before it can be used with a certainty of producing good results; therefore I would strongly advise the beginner to defer the purchase of one until he has obtained some experience in working with an ordinary camera mounted on a tripod, and can turn out decent negatives with a reasonable amount of certainty.

CHAPTER XXI.

COPYING.

The Advantages of Photography as a Means of Reproduction—Three Essentials—Lighting—The Plate—The Development—How to Make a Copying Apparatus—The Lens—Focussing—Copying Same Size—Enlarging—Reducing—Lighting—The Use of a Reflector—Copying by Artificial Light—Exposure—The Plate—Quick Plates—Photo-Mechanical Plates—Hydroquinone Development Recommended—Copying Silver Prints—Unmounted Prints—Copying Coloured Prints, Paintings, etc.

Of the many applications to which photography may be put, perhaps there is not one more useful than copying. So far as the mere reproduction of detail goes, photography excels in accuracy the work of the most skilful draughtsman. For copying old and valuable engravings, woodcuts, and line drawings, for the reproduction of diagrams, maps, and plans, its aid is invaluable. But probably the first work of this kind which the beginner will attempt will be the copying of a photograph, for although many people will not submit themselves to the tender mercies of the amateur portraitist, yet they do not mind handing over their "counterfeit presentment" to him in order to get it copied. It is by no means a difficult matter to copy a photograph, but it is not so easy to make people understand that the copy, in most cases, will probably be somewhat inferior to the original. However, this is not always so, for if the original happen to be an old and faded silver print, a very great improvement may sometimes be effected in the copy.

The essential matters to be attended to may first be roughly enumerated, each one in turn being subsequently considered in detail. First, and of chief importance, the lighting of the subject to be copied; secondly, the employment of a suitable plate; thirdly, a special system of development.

The picture or photograph which is to be copied may be simply secured to a wall, or to a drawing-board, with drawing-pins, but the work will be very much facilitated, especially if any great amount of it is in contemplation, if a special copying apparatus be devised. Such an arrangement as that which I am about to describe may be easily constructed, and at very little cost. Its size will of course depend upon the nature of the work which is to be undertaken, but the dimensions given will enable originals up to 2 ft. square to be copied up to the half-plate or any less size. A piece of nicely-planed board 1 in. thick, 4 ft. 6 in. long by 11 in. broad, should be procured, to form a base-board. To one end of this a drawing-board should be securely screwed with two iron angle brackets at right angles. To this the print or photograph is to be attached with drawing-pins. Sometimes, however, the print or picture to be copied is bound up in a volume. In such a case the book may be secured to the drawing-board by means of two strips of wood and four screw clamps. We must now devise some means of fixing the camera, so that when in position the lens will point to the centre of the drawing-board. Procure a piece of half-inch board the exact width of the base of camera, and 12 in. long, bore a hole in the centre to admit of the camera screw, now attach two other pieces as side supports, allowing about $\frac{1}{4}$ in. to project on each side so as to keep the base of the camera perfectly square. Now screw down to the baseboard two long strips of wood, just far enough apart to allow the camera support to slide stiffly between them. The diagram to be copied having been pinned up, the camera is screwed to the support, and the focus roughly ascertained by sliding the arrangement backwards and forwards, the fine adjustment being effected with the rack and pinion.

The best lens to use for copying is the rapid rectilinear, although a wide-angle rectilinear is sometimes more convenient, as it enables the camera to be placed nearer to the object to be copied. It is very necessary to focus accurately. This should be done with the full opening of the lens, after which a small stop should be inserted in order to get the sharpest possible definition to the margin of the plate; *f*/32 I usually find sufficient for the purpose. If the copy is to be the same size as the original, the camera must be racked out to twice the focal length of the lens used, the lens being placed at the same distance from the object to be copied. If a larger sized reproduction is required, the lens must be nearer to the original; or, if reduction is required, the distance between the two should be increased.

Either daylight or artificial light may be employed. If the former is preferred, the apparatus should be placed on a firm table in front of and at right angles to a window, if possible, facing north. This will give a strong side-light, and would, when copying engravings or photographs give a very bad effect, the mode of lighting exaggerating the grain of the paper. To remedy this, a small bedroom mirror should be placed on the shadow-side of the picture, and so adjusted as to throw as much reflected light as possible on the picture to be copied. A picture on even rough paper should not show any marked granularity when lighted in this way. The same system is employed when copying by lamp or gaslight. The illuminants in this case, whether gaslights or oil-lamps, are placed on both sides of the apparatus, and in such a position that neither source of light is included in the field of the lens, and it is well, in any case, to place a cardboard or other screen between the source of light and the lens. The proper amount of exposure can only be learnt by experience, though after very little practice, the conditions being much more uniform than when photographing in the field, it will be a comparatively easy matter to determine it correctly.

The excellence of the result will depend to some extent upon the plate which is used. Now, an extra rapid plate is the worst possible for this class of work, and the slowest obtainable should be chosen. There are plates specially made for the purpose, called photo-mechanical plates. Some of these should be obtained, as good results will be more easily obtainable upon them than upon ordinary plates. They are very slow, probably not half so rapid as ordinary plates. In copying line engravings the great point to aim at is to secure sufficient density in the opaque portions of the negative, at the same time keeping the lines clear and free from fog. In other words, we want great opacity combined with extreme clearness. These qualities will not be easily obtainable with quick plates, but will not be difficult to secure on the specially-prepared plates to which I have referred. An exposure as nearly accurate as possible having been given, it becomes, of course, necessary to develop the plate. Now, undoubtedly, the best developer to employ for this particular work is hydroquinone, and its tendency, when used for ordinary negative work, to give extreme density and contrast becomes, for this special purpose, an advantage rather than a defect. Equal portions of the stock solutions, directions for preparing which were given in the chapter on the preparation of the solutions, should be poured into a clean developing cup, and half its bulk of water added. This should then be applied to the plate. If the exposure has been approximately correct, the image will appear slowly and regularly, and development must be continued until a dense and vigorous negative is obtained. If the plate has been properly exposed, the clear portions of the negatives should remain unclouded and free from veil or fog until the last. If, however, they begin to veil before sufficient density is obtained, the exposure has been excessive, and the plate must be removed from the developer, washed, fixed, and, if a second plate cannot be exposed, which is by far the best plan, the over-exposed one should be intensified; but with the photo-mechanical plates it should not be necessary to resort to intensification if the exposure has been correct.

In copying silver prints it is better, when possible, to have them enamelled, as there will be less granularity in the copy. Care, however, must be taken to avoid reflected light from the glazed surface; this can be easily managed by adjusting the mirror or reflector. Unmounted prints are best soaked in clean water, and carefully squeegeed to a sheet of glass; not, of course, face downwards, as to photograph through the glass would probably give distortion, and reflections would be difficult to avoid. This mode of treatment takes out all creases, and does not injure the photograph. Bromide and platinotypes may, if desirable, be treated in the same way.

When coloured pictures, water-colours, oil paintings, or chromo-lithographs have to be copied, the use of isochromatic plates becomes indispensable; but as their employment confers such great advantages, I propose to devote the next chapter to a description of their special properties and use.

CHAPTER XXII.

ISOCHROMATIC OR COLOUR-SENSITIVE PHOTOGRAPHY.

Isochromatic Plates—Their Advantages—How Prepared—Dipping Process—Emulsion Process—Tailfer's Patent—Edwards' Isochromatic Plates—Further Improvements Desirable—Special Advantages—Necessity for Manipulating in Ruby Light—Further Precautions—Development—The Use of "Screens"—A Useful Experiment—Photographing Skies—Length of Exposure with Screens.

It will soon become apparent, to even the most unobservant reader, that photography does not with even approximate accuracy reproduce the true gradations of light and shade, nor render in monochrome colours according to their proper value. Ordinary plates are almost insensitive to red, scarcely more so to orange and yellow, and reproduce most greens badly, at the same time being unduly sensitive to blue and violet. Chemists, recognising this shortcoming of photography, have long turned their attention to the producing of plates which shall be more equally sensitive to the various colours of the spectrum, and the result of their investigations has been the introduction of what are known as isochromatic or orthochromatic plates. The terms are practically synonymous, and signify equal or true rendering of colour. It would be beyond the scope of a practical and elementary guide-book to go into the history of the process here, or to describe its nature, except in the briefest possible manner. Fortunately for the amateur, isochromatic plates are now an article of commerce, therefore it will not be necessary for the reader, from a practical point of view, to trouble himself with any details of their manufacture. They may be produced in two ways: first, by dipping, or bathing, ordinary plates in a solution of erythrosine, one of the very numerous coal-tar derivatives; plates so prepared, however, will not retain their keeping qualities, and therefore must be used directly after being prepared. The alternative method is due to M. Tailfer, a Frenchman, and is the subject of a patent; and Mr. Edwards' isochromatic plates, produced under licence by this process, have acquired a well-deserved reputation for their uniform reliability and excellence. I have used isochromatic plates from the time of their introduction, and for most purposes I consider they are far superior to ordinary plates. Photographers generally, however, have until recently been slow to adopt them, or to recognise their advantages; one probable reason for this I shall refer to later. So very much better are they than ordinary plates that I have not the least hesitation in expressing the opinion that the day is not very far distant when colour-sensitive plates will be almost exclusively used; and the fact that quite recently one of the largest firms of plate-makers* have considered it worth their while, as a business speculation, to purchase the right of making such plates from Messrs. Edwards, is strong evidence of the correctness of the assertion. Finality, however, in the preparation of colour-sensitive plates is very far from being reached, and several gentlemen who have devoted much attention to the investigation of the subject are still hard at work in this direction.

From a practical point of view isochromatic plates may be regarded as superior to ordinary plates for the following special purposes: copying oil or water-colour paintings and coloured diagrams, landscape work generally in which green or yellowish green is the prevailing colour, and more particularly when the foliage has assumed the brown and yellow tints of autumn; they also render clouds better and more truthfully than do ordinary plates, while portraits taken upon them require less work from the retoucher's pencil.

The one drawback to the use of isochromatic plates, if such it can be said to be, lies in the fact that they can only be safely manipulated in light of *a deep ruby colour*, and to a disregard of this precaution a good many failures are readily attributable. It needs very little reflection to demonstrate that a plate which is capable of accurately rendering orange and yellow cannot safely be manipulated in a light of that hue. Ruby light only, and that of a proper character, should be employed. It is better not to expose the plates unnecessarily to even ruby light, and in filling the dark-slides it is well to get as far from the light as possible. During development a light wood or cardboard cover should be placed over the dish until the image is well out.

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* The Ilford Dry Plate Co.

In regard to the actual development of isochromatic plates, their treatment does not essentially differ from that applicable to ordinary plates, only that with those of Edwards' make it is very easy to secure density, so that with subjects showing much contrast less pyro. is necessary.

The makers, in their instructions, advise the use of the fixed alkalis, either the carbonates of potash or soda, rather than liquor ammonia, inasmuch as if an excess of the latter be used fog would probably result. The same, however, applies, though perhaps in a less degree, to ordinary plates, and I invariably employ ammonia without meeting with any ill effects. Hydroquinone is recommended by some workers, but, owing to its tendency to give negatives of a chalky nature, I seldom use it. There is, however, less chance of fog when employing it than when the pyro. and ammonia developer is used. There is one precaution which, after what has been said, will probably be obvious, and that is, that when examining the negative for detail and density during the progress of development it should not be exposed for long, or held too near the dark-room window or lamp, as the plates are, to some extent, sensitive to even the ruby light of the dark-room.

In order to obtain the full advantages of colour-sensitive plates it is necessary to use a "screen." This is a disc of yellow glass, varying in depth of tint from a very pale lemon colour to a much darker yellow. It may be obtained to fit inside the lens mounts, or behind the lens itself. The object of using a "screen" is to cut off some of the blue and violet rays, which have too great an effect upon even an isochromatic plate when used without a screen.

The chief advantage of the screen is found when copying paintings. Its use is then invaluable, and it would be both interesting and instructive to the reader if he were to make three copies of a brilliantly coloured painting or chromolithograph; the one on an ordinary plate, the next two on isochromatic plates with and without a screen. If full justice has been done to each negative, a most striking difference in quality will be apparent, the isochromatic plate *used with a screen* giving by far the most truthful rendering of the subject.

For photographing cloud and sunset effects isochromatic plates give results distinctly better than those obtainable on ordinary ones. The finest effects of this kind are usually obtainable in the spring and autumn, when, as a rule, stormy and strongly-marked skies prevail. From about an hour before to the period of actual sunset is, perhaps, the best time to get effects of this character. A suitable standpoint having been selected (if the negatives are to be used for double printing, a low horizon should be chosen) the camera is directed towards the sun itself. A moment when it is obscured or partially obscured by a cloud should be selected for the exposure, which should be given by means of a shutter of the "blind" type, or with one of the Kershaw pattern. Supposing the lens to have been stopped down to about *f*/22, a medium isochromatic plate used without a screen would require about a quarter of a second exposure. This is assuming the sun to be obscured and very near the horizon, and the sunset to be a yellow one. Very beautiful effects are to be obtained in this way. For such work a screen is generally unnecessary, the yellowness of the sunset compensating for its absence.

For general landscape work it is not necessary to use a screen, though very often better results will be obtainable if one be used. In such case it should be very light in colour—a pale lemon yellow. The effect of the screen is to render the plate still less sensitive to violet and blue; therefore it will be seen that if too deep a colour is chosen the photograph will be untrue, owing to too much of those colours having been cut off. For copying coloured pictures, diagrams, or paintings, or for photographing flowers, a deeper screen should be employed, which will, of course, necessitate a much more prolonged exposure. For copying purposes, or for landscape work where the full effect of the process is desired, the medium rapid isochromatic plates should always be used in preference to the instantaneous. The use of a light screen will double or treble the exposure, and with a dark screen four or five times the ordinary exposure may be required, but when copying length of exposure is a matter of minor importance. No definite rule, however, can be given, and these times are merely approximate.

CHAPTER XXIII.

FLASH-LIGHT PHOTOGRAPHY.

Probable Origin of the Flash-lamp—Capabilities—Flash-lamps in General—England's Lamp—How to Connect several Lamps and Fire them Simultaneously—Arrangement of the Lamps—Home Portraiture—Focussing, an alternative Method—Gun-cotton and Magnesium — Drawbacks — Necessary Precautions—Flash-mixtures, Dangerous Nature of—Taking Dark Interiors—A Difficult Subject, how taken—Development.

If powdered magnesium, or magnesium dust, be forcibly blown through a flame a rapid combustion of the metal takes place, and the result is a brilliant flash of light. Various other substances, in themselves non-combustible, may be made to ignite in the same way. Indeed, the flash-lamp of to-day was probably suggested by the old-fashioned plan of producing stage lightning by blowing powdered lycopodium through a flame. The light produced by the magnesium flash is sufficiently actinic to permit of a photograph being taken with it, and, indeed, if a little trouble be taken, most excellent results may be obtained. The exposure being practically instantaneous, the sitters can be taken in an ordinary room, and whilst engaged in ordinary occupations in natural attitudes without fear of movement.

A great deal of ingenuity has been expended in the construction of "flash-lamps," as the apparatus used in producing the light is called, and the reader will find in the shop of any dealer in photographic materials quite a bewildering assortment from which to choose. It is not my intention here to describe in detail the merits or demerits of the different forms of lamps. Some, no doubt, are more efficient than others, but a suitable lamp should be easily procurable for about 4*s*., or even less. The general principle of construction is the same in all lamps, that shown in fig. 26 being designed by Mr. England: A is a metal chamber upon the top of which a wad of felt, which has been saturated with methylated spirit, is placed; B is a tube in which the magnesium powder is placed, about 10 gr. being sufficient. The tube B comes out at C, and is there connected, by means of a piece of india-rubber tube, with a collapsible india-rubber ball. Upon smartly squeezing the ball the air-pressure drives the magnesium powder through the flame, producing an elongated flash of great brilliancy.

It is difficult to get the best effects of lighting with only one lamp, and much better results will be obtained if two, or even three, are employed. It will, of course, be necessary to so arrange matters that the three flashes shall be simultaneous; but this is by no means difficult to do. Supposing three lamps are to be employed, a prong-shaped piece of tube must be procured of the shape shown in fig. 27. The lamps are connected by lengths of tubing to 1, 2, and 3, No. 4 being connected by means of another piece of tubing to the pneumatic ball arrangement, or, better still, when several lamps have to be fired simultaneously, to a pair of ordinary bellows.

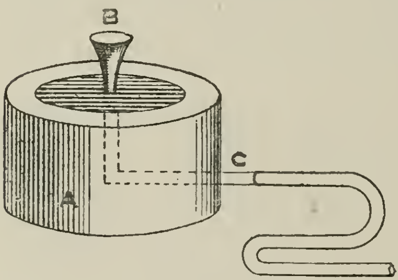


FIG. 26.

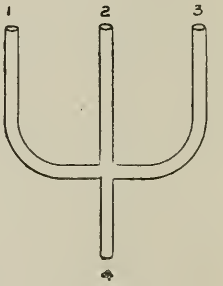


FIG. 27.

The general directions given in the preceding chapter upon indoor portraiture apply equally when the exposure is made by flash-light, and, therefore, it will not be necessary to repeat them again here. The most important matter to be attended to is the arrangement of the lamps. The object to be aimed at is to get a good soft lighting, which will bring out the features in well-modelled relief. This, as I

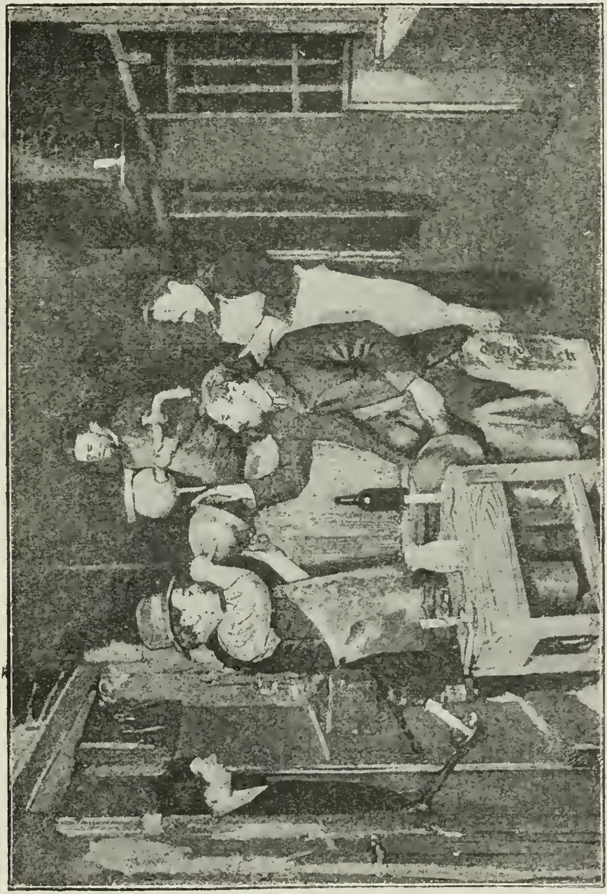


Fig. 28.

previously mentioned, it is difficult to do with one lamp, and the most suitable disposition of the lamps and sitter may best be shown by the aid of a diagram. In fig. 29, A represents the sitter, or sitters, B being the camera, and C, D, E the three lamps. These must always be either behind the camera, or at any rate screened from the lens, and well out of its field, or hopeless fogging of the plate will result. If the lamps are placed close together a hard unpleasant lighting with heavy shadows is likely to result, but by placing them in the position shown in the diagram an artistic effect should be produced. The great advantage of this system of lighting over ordinary daylight is that the sitters may be placed in any desired part of the room, and one is not hampered with any such considerations as getting the most suitable lighting from the window. Very natural and pleasing pictures may be taken in this way, but much will, of course, depend upon the artistic ability of the operator.

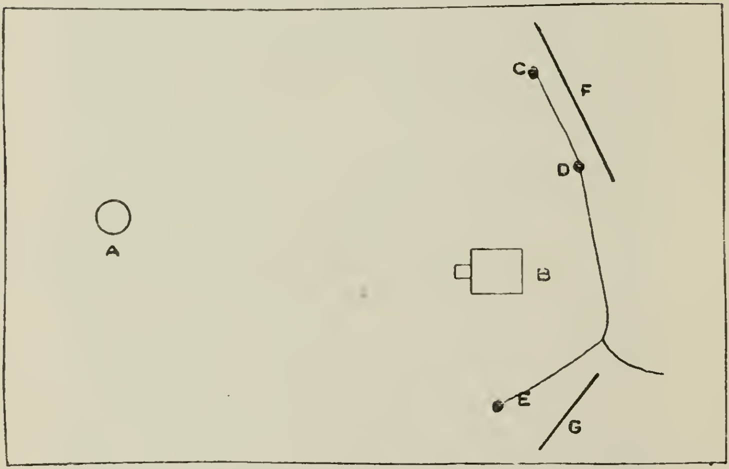


Fig. 29.—Plan of Room

Focussing presents some little difficulty. It is useless to attempt to focus the sitters themselves. The best plan is to place a lighted candle on the seats which they are to occupy, and sharply focus that. The candle being removed, the sitters may then be carefully posed, when, if the lens is a reasonably good one, it will be found that they will be quite sharp in the resultant negative. The lamps should not be placed too low down ; C and D should be about five feet from the ground, E being about three feet. The combustion of the magnesium results in the production of a dense cloud of white smoke, oxide of magnesium ; this subsequently settles in the form of a very fine powder, but will not cause the least damage to furniture. It is advisable not to make a second exposure until the fumes from the first flash have entirely disappeared. Many people disregard this caution, and then wonder why they get fogged, flat negatives.

Flash-light photographs may be produced without the aid of a flash-lamp by the following method :—A tuft of gun-cotton, weighing about 6 gr., is loosely spread out on a piece of sheet tin, or on the back of an ordinary tea-tray, and its surface sprinkled over with powdered magnesium, from 15 to 20 gr. should be sufficient. This may be placed on the top of a pair of steps, and ignited by means of a long wax taper. This method is almost as effective as the lamp, the chief drawback being the great amount of smoke that is produced, which, although perfectly harmless, causes a very unpleasant effect when inhaled. Gun-cotton being a very explosive substance when compressed, should not be tightly packed in the tin or vessel containing it, and should only be stored in small quantities.

A third method of utilising the magnesium light for photographic purposes is by the use of what are known as flash powders. All mixtures of this class are of a highly explosive and dangerous nature, both in their use and in their preparation, and I strongly advise the reader not to attempt to either make or use them. I shall therefore not give any formula for making them in "Elementary Photography."

Flash-light photography affords a means of securing photographs of dark interiors which it would be difficult, if not impossible, to secure by other means. As an instance of what may be done in this direction, I may refer the reader to the illustration, and which represents the interior of a wine vault in the City to which the light of day has never penetrated. The exposure was effected by burning a large quantity of magnesium and gun-cotton in the manner already described, assisted by an auxiliary flash-lamp, two assistants standing in recesses in the wall, also burning long strands of magnesium ribbon. Two negatives were taken, both of which proved fairly successful.

I have said nothing about development, for it usually presents no special difficulty, the plates, as a rule, being fully exposed and coming up without forcing. The only practical difficulty in taking flash-light portraits is in avoiding flatness on the one hand and hardness on the other. This being overcome the rest is plain sailing.

CHAPTER XXIV.

SOME ELEMENTARY OBSERVATIONS UPON THE ARTISTIC TREATMENT OF THE SUBJECT.

The Aim of the Writer—The Advantages of an Artistic Training—The Necessity for Study—Books to be Read—Some Leading Ideas—The Principal Object—Adjustment of Focus—How to Proceed—The Proper Use of Stops—Groups and Figure Subjects—The Pyramid—The Position of the Principal Object—Photographing Streets—Repetition of Lines—Balance—Light and Shade—The Shortcomings of Photography—Choice of Subject—Simplicity—Subjects to Avoid—Motive—The Position of the Horizon.

Anything in the nature of a treatise upon art would obviously be out of place in an elementary text-book, but photography and art are so closely united that to entirely abstain from referring to the subject would certainly be wrong.

I would say, at the outset, that the reader who takes up photography, possessing some prior knowledge, however slight, of composition, balance, light and shade, will find even a superficial knowledge of art principles of the greatest possible assistance in attempting to secure pictures by photographic agency.

It may, unfortunately, be said with truth of the majority of photographers, that they care little for, and pay small heed to, artistic considerations in the pursuit of their hobby. A great many people, having mastered all technical details, go on year after year producing photographs good from a technical point of view, but entirely lacking in pictorial merit. This, however, would not be the case if some slight attention were paid to the elementary principles which govern composition. It is, of course, infinitely easier to acquire a knowledge of photography than to learn to be an artist; but there is no reason why a small amount of study and training should not make the reader a little of each.

It must not, however, be inferred from the foregoing observations that the mere knowledge of certain so-called "rules of art" will enable the reader to straightway go and produce good pictures. The two best books upon this subject, *which a photographer can refer to,* have been written by Mr. H. P. Robinson, and are called "Picture-Making," and "Pictorial Effect in Photography." I would strongly advise the reader to obtain copies of these, and "read, mark, learn, and inwardly digest" their contents.

Photographic views which are of an essentially topographical character may very often, by a little careful attention to the selection of the point of view, be considerably improved; but with such subjects I am not for the moment dealing.

It should always be remembered that every successful picture possesses some leading idea, some principal object of interest, all the rest being merely accessory or subordinate. The photographer, therefore, should always endeavour to give emphasis to the principal object by focussing it carefully, and making it the sharpest portion of his picture, and by careful adjustment of the focus it is possible to gain an effect of atmosphere and distance. In order to produce this effect the largest stops permissible should be used. As I have said, the principal object should be focussed sharply with the open aperture of the lens. If this object be in the immediate foreground, as it generally will be, the middle distance and distance will possibly be very indistinct and fuzzy; smaller stops should then be inserted until the middle distance is fairly but not microscopically sharp, the distance may then be left to itself. $F/16$ is a most useful aperture, and, if possible, a smaller stop should not be used, except it be for architectural subjects or special purposes.

In taking a group, or in composing a picture in which several figures form a prominent part, anything approaching symmetry, like a file of soldiers standing at "attention" (fig. 1 opposite), should be studiously avoided, and the figures grouped in a pyramidal form, as in fig. 2.

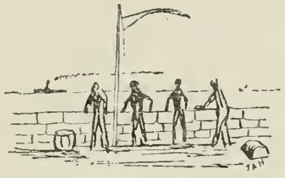


Fig 1

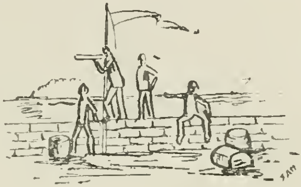


Fig 2

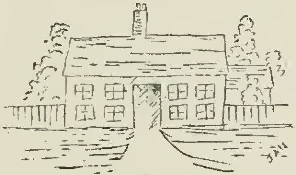


Fig. 3

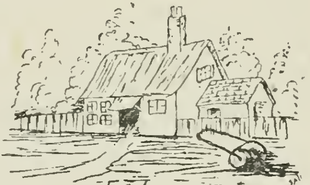


Fig 4

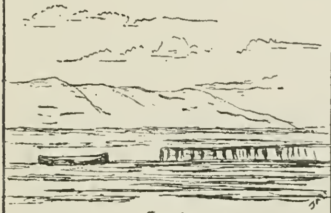


Fig 5

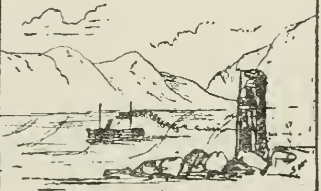


Fig 6

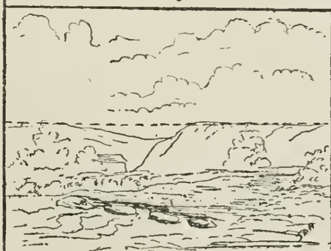
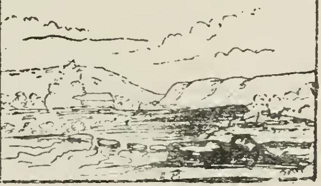


Fig 7



One of the rules of art to which I have referred is that the lines of the composition should be so arranged as to form a pyramid or series of pyramids. A striking example of this is to be found in Wilkie's "Blind Fiddler."

The principal object should never occupy a central position in the picture, for the centre is in reality its weakest point. For instance, in photographing a landscape with buildings, the latter should not be in the centre, but rather to the right or to the left; figs. 3 and 4 are illustrations of this. In the same way in photographing a street scene, the camera should never be placed in the middle of the road, but on one side, either to the right or left, so that the vanishing point may not occur in the centre of the picture. Try and avoid a repetition of lines as in fig. 5, either perpendicular or horizontal, because monotony is introduced; sloping lines opposed to each other are far more pleasing (fig. 6). By following this rule the effect known as "balance" will be obtained, and the picture rendered in a pleasing and effective manner.

Now, a few words on a most important subject, and one over which the photographer has some slight control; I refer to "light and shade." In dealing with form, the photographer is somewhat heavily handicapped, but, by making the exposure at the right time of day, and when the subject is most suitably lighted, he will be able to secure just the effect of light and shade desired. One reason why such a large number of photographs are so unpleasing, although the composition may be good, is due to the spotty and scattered nature of the lighting. This is particularly noticeable in landscape subjects where there is much foliage. The light is reflected from the small leaves in a distracting manner, which detracts greatly from the general effect. The light and shade in a photograph should be massed as much as possible, so as to secure breadth; very fine effects are sometimes obtained by bringing the highest light into strong contrast with the deepest shadow. But here it is necessary to remind the photographer that he cannot produce on a photographic plate the exact gradation of light and shade existing in nature; for, as I have endeavoured to explain in the chapter upon isochromatic photography, ordinary plates are less sensitive to some colours than to others, particularly to yellow and green, and it is for this reason that isochromatic plates are so markedly superior for landscape work. A great many landscapes excite our admiration solely on account of the beauty of their colouring, and this fact the photographer should always bear in mind: The plan is adopted by some, and it is one to be commended, of looking at the selected view through a piece of blue glass, or a pair of blue spectacles; it will then be seen whether the effect is due to local colouring only, or to a fine disposition of light and shade.

In regard to choice of subject a volume might be written, but here I must content myself with a few words. The beginner should confine himself to landscape pure and simple until he has made himself thoroughly acquainted with the use of his tools. Having done so he may then try the introduction of animals or figures into the composition, but only, of course, allowing them to occupy a subordinate or accessory part in the picture. Figure, *genre*, and group studies are to the photographer the most difficult of all, and the beginner, who has received no art training, would do well not to attempt them until he has acquired considerable proficiency in dealing with simpler subjects.

Simplicity, both in the subject and its treatment, is really the key-note to successful picture-making with the camera and lens. Extensive landscapes, seen perhaps from well-known view points are seldom well rendered in a photograph. A little bit of leafy lane, with a thatched cottage peeping through the trees, will probably make a far more pleasing photograph than a mountain range, or a wide tract of country. Remember the limitations of photography, and beware of attempting too much. Let every picture have a motive, and, as it were, tell its own tale; avoid meaningless composition—a collection of accessories without aim or object.

I will conclude these short comments upon what is really a very wide subject by a brief reference to a most important matter, viz., the position of the horizon line. It should rarely, if ever, be absolutely central, cutting the plate, as it were, into two equal portions (figs. 6 and 7). Whether it be high or low must, to some extent, depend upon the nature of the subject and the effect sought for. When photographing in a flat country, if it be desired to give the impression of distance, the horizon should be kept low, and should not be higher than one-third up the plate. If much foreground be included in pictures of this class, the feeling of distance is to some extent lost, owing to the fact that the lens, as a rule, includes too wide an angle of view, giving undue prominence to near objects, and consequently dwarfing the distance. A low horizon is generally easier to manage than a high one, though there are occasions when the high horizon is very effective. This is often the case in marine work, and particularly with upright pictures, but it will generally be safe to place the horizon line about one-third from the base of the picture.

I have now, I trust, written sufficiently upon this topic to induce the reader to seek further knowledge from such books as those from the pen of Mr. Robinson to which I have already referred.

CHAPTER XXV.

PLATES, PAPERS, ETC., AND THEIR PREPARATION.

Technical Knowledge Desirable—"Photography with Emulsions"—Dry Plates—How Prepared—The Emulsion—Sensitiveness—Digestion—Washing—Coating the Plates—The Operation Described—Drying and Packing—Deleterious Influences—A Word for the Plate-makers—Bromide Paper: How Made—Silver Paper—Albumenising—Sensitising—Preservatives—How to Keep Albumenised Paper—Celluloid Films—Drawbacks and Advantages.

Although it is quite possible to become a skilful photographer, and yet know little or nothing of the materials which are used in the production of the pictures, it cannot be doubted but that even a slight knowledge of the nature and preparation of the plates and papers and other materials in common use can be otherwise than helpful in times of difficulty, I therefore make no apology for adding this chapter to the pages of "Elementary Photography." I can, however, only treat the subject in the briefest possible manner, and I would refer the reader who desires to extend his knowledge to Abney's "Photography with Emulsions," a book which all photographers should possess.

Astonishing as the statement may seen, there are not a few amateurs who, though able to produce very passable photographs, are totally unacquainted with the nature and mode of preparation of the sensitive plates and other materials which they are accustomed to use in the production of their pictures; but as I do not wish this reproach to apply to those whom this book may initiate into the mysteries of the art, I trust my readers will peruse and not pass by this chapter.

The modern dry plate consists of a sheet of glass evenly coated with a sensitive preparation technically termed an "emulsion." This emulsion consists of bromide of silver, mechanically suspended in a very fine state of division, in a solution of gelatine. The emulsion is prepared by dissolving either bromide of potassium or bromide of ammonium in water, with a small quantity of gelatine. A second solution is made by dissolving nitrate of silver in water. Then, in the dark-room, the silver solution is added to the bromide solution slowly, and with vigorous stirring, when the bromide combines with the silver, and forms bromide of silver, which is the sensitive silver salt. It is very essential that the combination should take place slowly, in order that the silver bromide may be produced in a fine, and not a coarse condition, the former being found to give better results than the latter. This is effected commercially by special mixing apparatus, not unlike a huge churn in appearance. An emulsion so prepared would be too slow for general purposes, and the vessel containing it is placed in a hot-water apparatus, in which the emulsion is kept at a high temperature, or even boiled, for a certain time, until the required sensitiveness is attained. When this stage is reached, the emulsion is allowed to cool and the necessary quantity of gelatine added; for were the full amount used in the first place and during the boiling process, it would lose its setting properties, and the plates, when coated, would not dry. Before the emulsion is in a fit state for coating the plates it has to be "washed," in order to remove the soluble nitrate of potassium, which is formed at the same time as the insoluble bromide of silver. The emulsion is forced through coarse canvas, a silver grating, or broken up by other mechanical means into small particles. These are enclosed in a suitable apparatus, and a continuous current of water passed through until all the soluble salts are dissolved. The emulsion is then drained and re-melted, when it is ready for coating.

Formerly plates were coated by hand, but now all commercial plates are coated by machinery. An endless band carries the glass plates underneath a vessel containing the liquid emulsion, by which they receive a thin and even coating of emulsion; the endless band, which is kept travelling at a uniform rate of speed, takes the coated plates onward through a short metal tunnel, the outside of which is packed with ice; this causes the films to set, and upon their emerging from the far end, an assistant lifts them off, and stacks them in racks, which, when full, are removed to the drying chambers or darkened rooms, through which a continuous current of air is passed, generally by mechanical means. When dry, the plates are, in all good factories, properly tested, and, if approved, passed on to the packers, who put them up in the boxes which are so familiar to photographers.

It will be seen from this brief account that the preparation of an emulsion is by no means an easy matter, and if the reader only knew the infinite care and trouble which the leading plate manufacturers take in order that they may be in a position to offer their customers a reliable article they would pause before attributing their failures to their plates rather than to themselves. Some plates possess better keeping qualities than others, but all are liable to deteriorate if exposed to damp or the fumes of gas; therefore these adverse conditions should always be avoided.

Perhaps gelatino-bromide paper ranks in importance next to the dry plate. It is, as its name indicates, paper coated with gelatine emulsion. The emulsion is prepared in the same manner as that used for plates, the only difference being that it is far less rapid, and less gelatine is employed. Indeed, in some papers, particularly those with a rough surface, the quantity is reduced to a minimum.

Ordinary albumenised silver printing paper undergoes two processes in the course of its preparation. Large sheets of specially-made paper, usually of German manufacture, are first albumenised by floating on large dishes containing albumen, to which a certain proportion of some soluble chloride has been added. After flotation the sheets are removed, and dried in a warm room. So prepared, the paper will keep indefinitely. This part of the process is very often done in Germany, from which country the bulk of the albumenised paper used in England is imported. The paper is made sensitive to light by floating it on a silver bath containing about 60 grains of nitrate of silver to the ounce of water. After floating for three minutes, the sheets are removed, and hung up to dry in a warm room. Paper so prepared will not keep very long, and must be used fresh. The method by which the manufacturers confer keeping qualities upon their sensitised papers is a trade secret; but the result may be achieved by floating the paper on a bath of citric acid, or by keeping the paper between folds of blotting-paper, which have been soaked in a saturated solution of carbonate of soda, and dried. The secret of preserving ready-sensitised paper for a long period is to keep the air from it, and the best way of doing this is to store it under pressure, either in a large printing-frame or in a press. If it be first wrapped up in some old or discoloured sensitised paper it will be found to keep almost indefinitely.

Glass has until recently been almost exclusively adopted as a support for the sensitive material, but recent improvements in the manufacture of celluloid have led to the adoption of the latter material for the same purpose, and celluloid films, as they are called, are now largely used by amateurs. Their chief advantage lies in the great reduction of weight and bulk, and the absolute immunity from any danger of breakage. The chief and perhaps only drawback to their use is the difficulty experienced in getting them to lie flat in the dark-slide during exposure. This is greatly obviated by the use of a carrier, several patterns of which are now procurable, one of the best and lightest being England's cardboard carrier. The manipulation of the ordinary thick films does not in any way differ from that of ordinary plates, but with the very thin rollable films, a little care is necessary in order to keep them beneath the surface of the developer. If a dish with a plain bottom be used and wetted, and the film then placed in it, the capillary attraction will be sufficient to cause it to adhere, and will prevent it from rising to the surface of the developer.

CHAPTER XXVI.

CONCLUSION.

In the foregoing chapters I have endeavoured, as concisely as possible, but without omitting anything which would be useful to the beginner, to describe the actual procedure necessary to successfully carry out the various processes in ordinary use for the production of photographs at the present time. Much more, no doubt, could be easily written on some of the topics dealt with, but I have endeavoured to deal with each branch of the subject in such a simple manner as to enable the youngest or most ignorant reader of the "Amateur Photographer's Library" to obtain an intelligent grasp of it, and I have from time to time given references to authorities, so that the reader may, if he so desires, further extend his knowledge.

There is a mass of literature upon the subject, but much of it will be of little practical value to the beginner; he must therefore learn to discriminate between the wheat and the chaff. In particular much that is profitless has been written upon the artistic possibilites of photography, and the reader who seeks merely for instruction will find all that he will require, from a photographic point of view, in the works of H. P. Robinson, on the subject, who, besides being a photographer, is a painter of no mean ability.

Turning to the technical aspect of photography, the writings of Captain Abney deal most exhaustively and completely with the whole subject, and I have to acknowledge my indebtedness to them. To "Photography with Emulsions" I have already referred; his "Instruction in Photography" and "Treatise on Photography" should also be studied. The chemistry of the subject should not be neglected, and Hardwick's "Photographic Chemistry" and

J. T. Taylor's "Photographic Chemistry" should both be procured. The latter author has also recently written a most valuable work upon "Photographic Optics." As a book of reference E. J. Wall's "Dictionary" will be found extremely useful, and the same writer's "Photographic Procedure," bids fair, from the exhaustive manner in which it deals with each topic, to be even more so. A knowledge of the history of photography will be gleaned from a little book by Mr. Werge, entitled "The Evolution of Photography." The foregoing books may justly be termed standard works upon photography, and would form the nucleus of a good reference library. Improvements have taken place in photographic methods during the last few years by leaps and bounds; but although it is hazardous to attempt to prophesy as to the rate of future progress, yet it would appear that for some time to come further advancement will proceed more slowly than in the past. Improvements in processes and in methods, however, continue to be made, and in order that these may be intelligently followed, it becomes necessary to read the current literature upon the subject. Therefore the beginner will derive the greatest possible benefit by becoming a subscriber to one of the weekly papers devoted to photography. Of the four or five of these which are now published, the *Amateur Photographer* is perhaps most suited to the particular requirements of the amateur; it is, in fact, the only paper which is exclusively an amateur organ, though its pages are by no means shut to the professional, some of whom, bearing honoured names in photographic journalism, are constant contributors to it.

I have endeavoured throughout to treat every subject upon which I have written in the most elementary manner possible, using language as free from technicality as I could command. The instruction has been progressive, therefore I would urge upon the beginner to first read the book from cover to cover, and then, commencing at the beginning, follow the procedure laid down to the letter, and chapter by chapter, in their proper sequence. The principle which I have endeavoured to follow in imparting the information which I was seeking to convey, was to give one well-tried and successful method of working, and one only. In photography, as in other things, there are more ways than one of arriving at the same result, but ringing the changes on developers, plates, and processes is the worst possible course which can be adopted. But I may be permitted to say that every process and mode of treatment of plate or paper mentioned in these pages has been practically tested and found not wanting by the writer during an experience now running rapidly, alas, into two decades.

Although the introduction of the gelatine process has made successful photography far easier of attainment than in the days of collodion, yet the reader will at times meet with disappointment and non-success. When it is remembered that the same thing not unfrequently happens to even the most experienced, it will be understood that something more than the mere "pressing of the button" is required on the part of the learner, if he be determined, from the beginning, to himself do the rest, rather than depute it to others. Let him not, therefore, be discouraged by failures, but begin again from the commencement, and endeavour to trace the cause of the trouble to its source. Failures, if regarded intelligently, are helpful rather than retrogressive.

If near the headquarters of a photographic society, become a member of it. Even though it be but a small affair, and its members not more experienced than yourself, you must be the gainer, rather than a loser, by your intercourse and exchange of ideas with them. Always remember when real difficulty occurs, the surmounting of which seems impossible, that a plain statement of the facts addressed to the Editor of a photographic paper will meet with kindly and efficient attention.

In conclusion, let me again remind the reader that there is no royal road to success in photography; he must learn to walk before he can run, but if that which I have written proves of assistance in guiding his footsteps, my object in writing will have been fulfilled.

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